Diesel Power

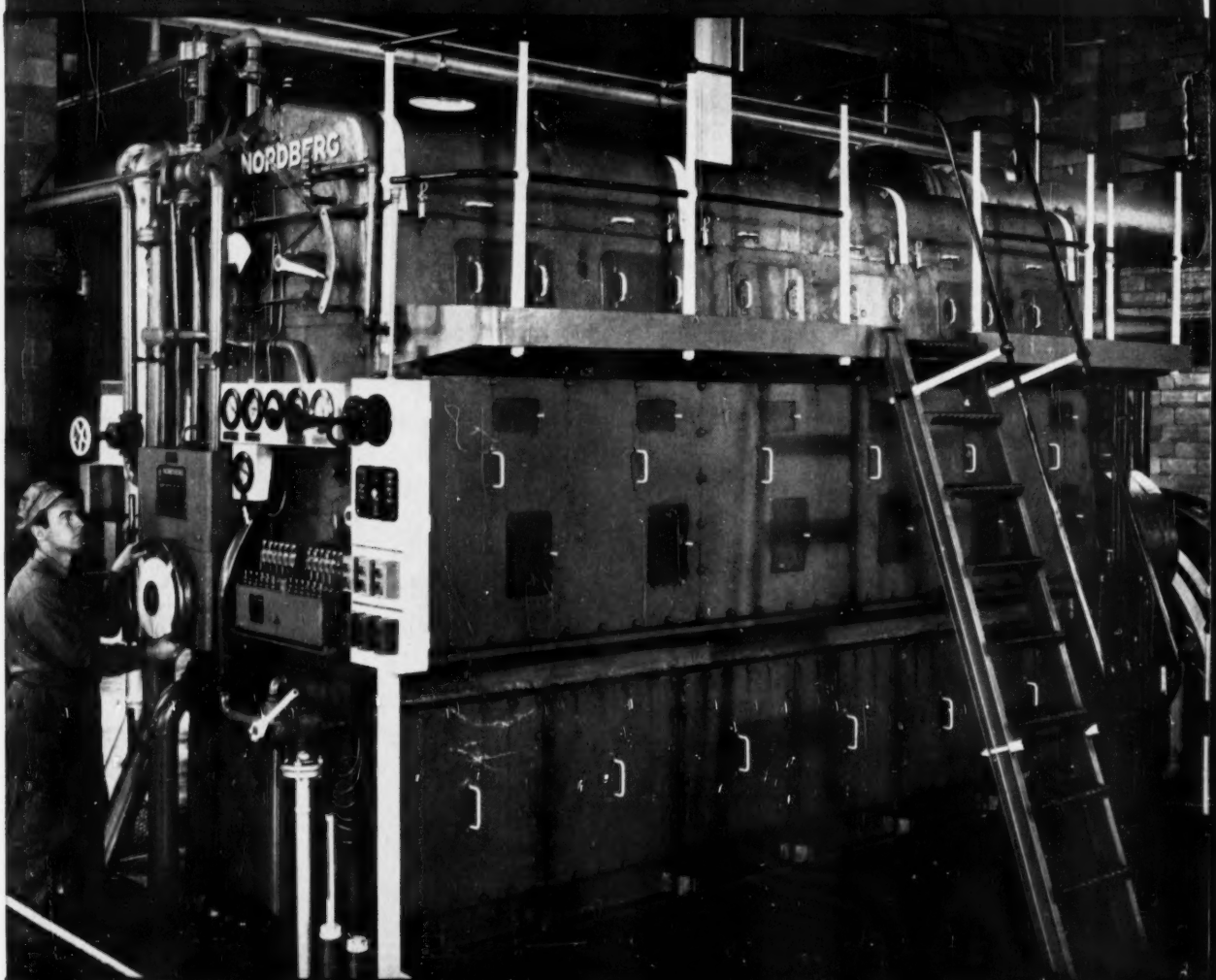
& Diesel Transportation

Our 22th Year

JANUARY, 1951

BUYERS' GUIDE NUMBER

A record of LOW



Elkhorn, Wisconsin, Municipal Power Plant. This Nordberg Rexfuel engine is a four-cycle, six-cylinder, supercharged unit driving an 875 kw Elliott generator. Natural gas is burned except during extreme cold weather when the engine goes on oil fuel.

Use of Texaco Urex Oil for lubrication has played an important part in reducing power costs by more than 30%.

TUNE IN...
TEXACO STAR THEATER
starring
MILTON BERLE
on television
every Tuesday night.
METROPOLITAN OPERA
radio broadcasts every
Saturday afternoon.

TEXACO
REG. T.M.

TEXACO

MAINTENANCE COSTS

TEXACO URSA OIL produced 3 savings in this gas-burning Diesel

MR. A. J. WOLFF, Superintendent of the Elkhorn (Wisc.) Light and Water Commission, reports the following cost-saving results from lubricating with *Texaco Ursa Oil:*

1. Clean operation—minimizing wear and assuring lower maintenance costs, longer engine life.
2. Long oil service life.
3. Low lube oil consumption—4301 kw-hrs per gallon.

Low maintenance costs are an old story to operators using *Texaco Ursa Oils* to lubricate Diesel, gas or dual-fuel engines. These world-famous oils have top resistance to oxidation . . . keep engines free from harmful sludge and carbon . . . assure free rings for proper compression and perfect combustion. Lower fuel consumption goes along with lower maintenance costs.

Texaco Ursa Oils are approved by leading engine builders and preferred by operators everywhere. In the Diesel field, for example—

More stationary Diesel h.p. in the U. S. is lubricated with Texaco Ursa Oils than with any other brand.

Let a Texaco Lubrication Engineer help you gain more efficient, more economical engine operation. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

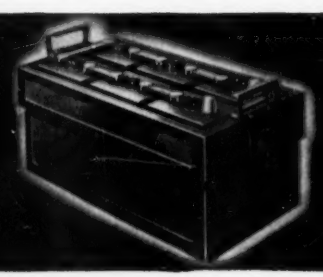
URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

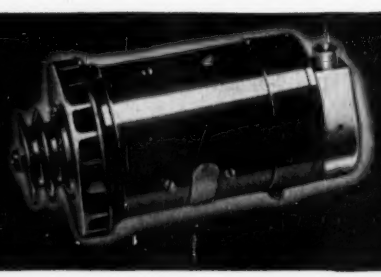
Switch to AUTO-LITE diesel equipment

● The result of Auto-Lite's 40 years of automotive electrical experience, Auto-Lite Diesel systems are complete from generator to voltage control to battery to starter. The dependability of Auto-Lite electrical units in service has made Auto-Lite the world's largest independent manufacturer of automotive electrical equipment. Engineers and executives are invited to consult with us on Diesel cranking and generating equipment.

THE ELECTRIC AUTO-LITE COMPANY
Sarnia, Ontario Toledo 1, Ohio

Money cannot buy better diesel equipment . . .



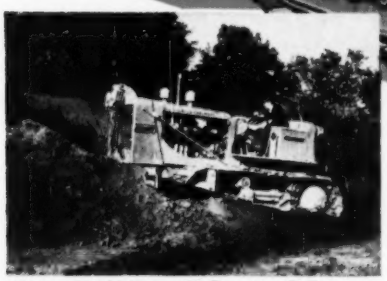


STARTERS
BATTERIES
GENERATORS

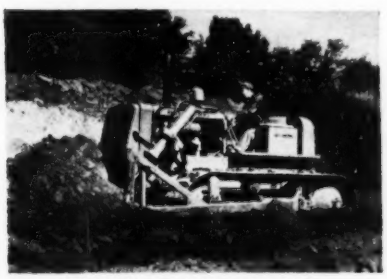
OUT AHEAD

with GM DIESEL POWER!

HD-20—41,800 lbs. of properly balanced weight; long, wide sure-gripping tracks and the new GM 6-110 Diesel engine driving through hydraulic torque converter give the Allis-Chalmers HD-20 brute strength to take toughest jobs in stride.



HD-15—27,500 lbs.—102 Drawbar H.P.—powered by a 6-cylinder GM Series 71 Diesel engine.



HD-9—18,500 lbs.—70 Drawbar H.P.—powered by a 4-cylinder GM Series 71 Diesel engine.

General Motors 2-cycle Diesel engines supply the hard-hitting power that enables Allis-Chalmers' great new line of tractors to outwork all others.

Four and six-cylinder GM Series 71 engines driving the HD-9 and HD-15—and the powerful new GM 6-110 engine driving the HD-20—give these new tractors a reserve of smooth, dependable power for easy handling, increased work and minimum maintenance.

The greater efficiency of 2-cycle operation and direct fuel injection simplifies design and enables these engines to produce far more horsepower than other Diesels of equal size and weight. Interchangeability of Series 71 engine parts provides maximum availability—keeps them on the job.

That's why GM Diesel engines are chosen to power not only the "World's most modern line of crawler tractors"—but more than 500 different kinds of machinery built by 120 manufacturers.

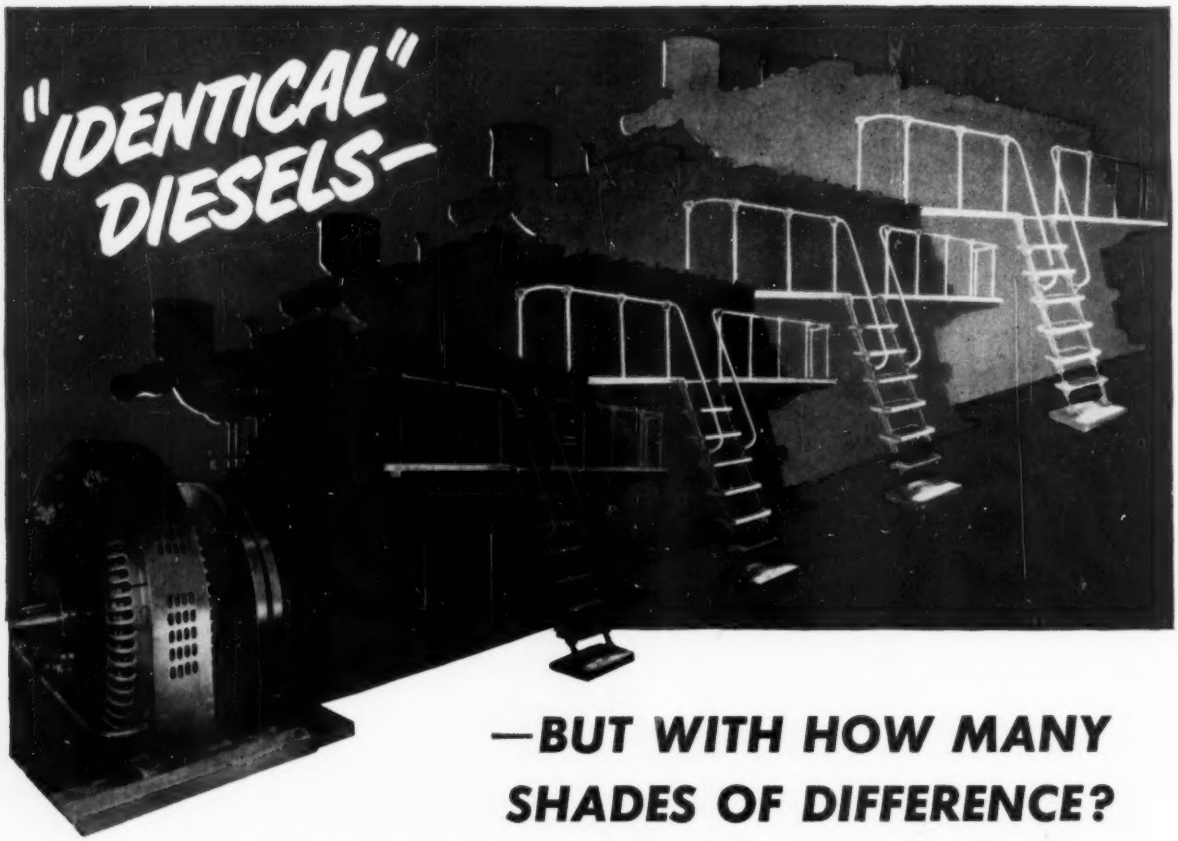
DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES . . . *Up to 275 H.P.* **DETROIT 28, MICHIGAN** MULTIPLE UNITS . . . *Up to 800 H.P.*

GENERAL MOTORS

DIESEL BRAWN WITHOUT THE BULK

GM GENERAL MOTORS DIESEL POWER



—BUT WITH HOW MANY SHADES OF DIFFERENCE?

When they're delivered to the buyers a number of Diesels may be identical in make and model. But in actual use . . . working in different plants and climates . . . differently loaded, operated and serviced . . . the "identical" Diesels soon differ even more than just a shade. That's one reason the lubrication which seems ideal in one particular case may cause a similar Diesel working elsewhere to run up unnecessary downtime.

You can guard against the adverse effects of such variables . . . against the improper lubrication of your costly Diesels . . . by calling in a Cities Service Diesel Lubrication specialist. He knows all types of Diesels and their lubrication; he knows practical plant procedure, too. That's why the Diesel lubrication schedule he will be glad to develop especially for you can provide far better protection for your Diesels—and for your profit showing. Contact the Cities Service office nearest you, or mail the coupon now for booklet on "Diesel Engine Lubrication."

The Cities Service complete line of top quality petroleum products includes a Diesel lubricant for every operating condition.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

CITIES SERVICE OIL COMPANY
Sixty Wall Tower, Room 905
New York 5, N. Y.

Please send me without obligation your booklet on Diesel Engine Lubrication.

Name_____

Company_____

Address_____

City_____ State_____

let an old sea dog teach you new tricks

Take a tip from the hard-bitten experience of seasoned old seadogs who skipper diesel-powered fishing craft and other work boats. Pioneers in diesel use, they'll tell you that with modern diesel power there are new tricks you can learn in greater efficiency and unfailing performance . . . lower operating and maintenance costs . . . trouble-free, uninterrupted service.

Dependable fuel injection equipment supplied by American Bosch is a vital element in making possible these profitable results.

Through its extensive research, development and field engineering—unrivaled precision manufacture—and its strategic network of service agencies—American Bosch plays a big part in bringing the advantages of dependable, low-cost diesel power to ever-expanding and diversified fields of application.

Dependable Fuel Injection for the Diesel Industry

American Bosch

MAGNETOS • GENERATORS • VOLTAGE REGULATORS • IGNITION COILS
ELECTRIC WINDSHIELD WIPERS • DIESEL FUEL INJECTION EQUIPMENT

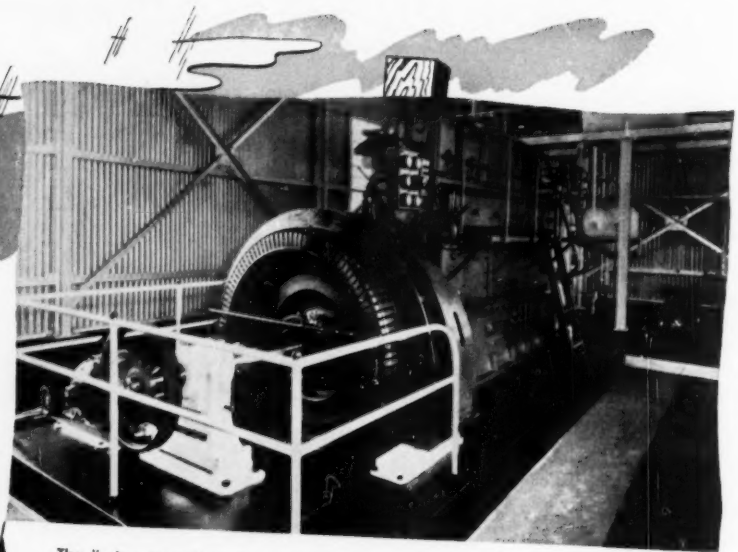
AMERICAN BOSCH CORPORATION • SPRINGFIELD 7 • MASS.

THIS TIME

. . . on the Bonneville Salt Flats . . . it's

DIESEL

performance!



The "prime mover" at the modern plant of Bonneville, Ltd., Wendover, Utah. A Worthington Supercharged Diesel Engine, Type SCC-6. Worthington auxiliaries are used for the water cooling system.

Worthington Engine Outstanding For Economy and Dependability Under Difficult Conditions

Organized in 1935, Bonneville, Ltd., is a primary source of commercial potash, producing 70,000 tons annually from the evaporating ponds in the Wendover, Utah, Salt Flats area. This remote site of the world's automobile speed records is far from public utility plants, even from adequate fresh water supply. Power, therefore, is a problem.

Management found the solution in a Worthington Supercharged Diesel, Type SCC-6, rated 489 hp at 4,250 ft elevation.

Replacing several small, high speed Diesels, the new Worthington unit is the sole electrical generating source in a set-up designed by Worthington engineers to deliver maximum power from the fuel consumed, and to operate with a cooling system requiring a minimum of make-up water.

For The Record

The Bonneville Worthington has lived up to every expectation for efficient, cost-cutting performance. *Consumption of fuel oil is at the rate of 14.25 kw hours per gallon at this altitude. Also, over 73% of the low-cost fuel oil is put to useful work — utilization of heat from the exhaust and from the cooling system (high-temperature type) being a main factor in achieving this high percentage.*

To a broad range of ratings including every type of heavy duty Diesel and gas engine, Worthington adds outstanding engineering knowledge and a rich background of experience — and technical assistance to help you get the most out of your own power planning. For further details of the dependable, economical Diesel performance that proves *there's more worth in Worthington*, contact *Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.*

WORTHINGTON

E.O.6

YOUR PARTNER IN POWER PROGRESS

Diesel engines, 150 to 3,520 hp . . . gas engines, 175 to 3,520 hp . . . dual fuel engines, 225 to 3,200 hp.

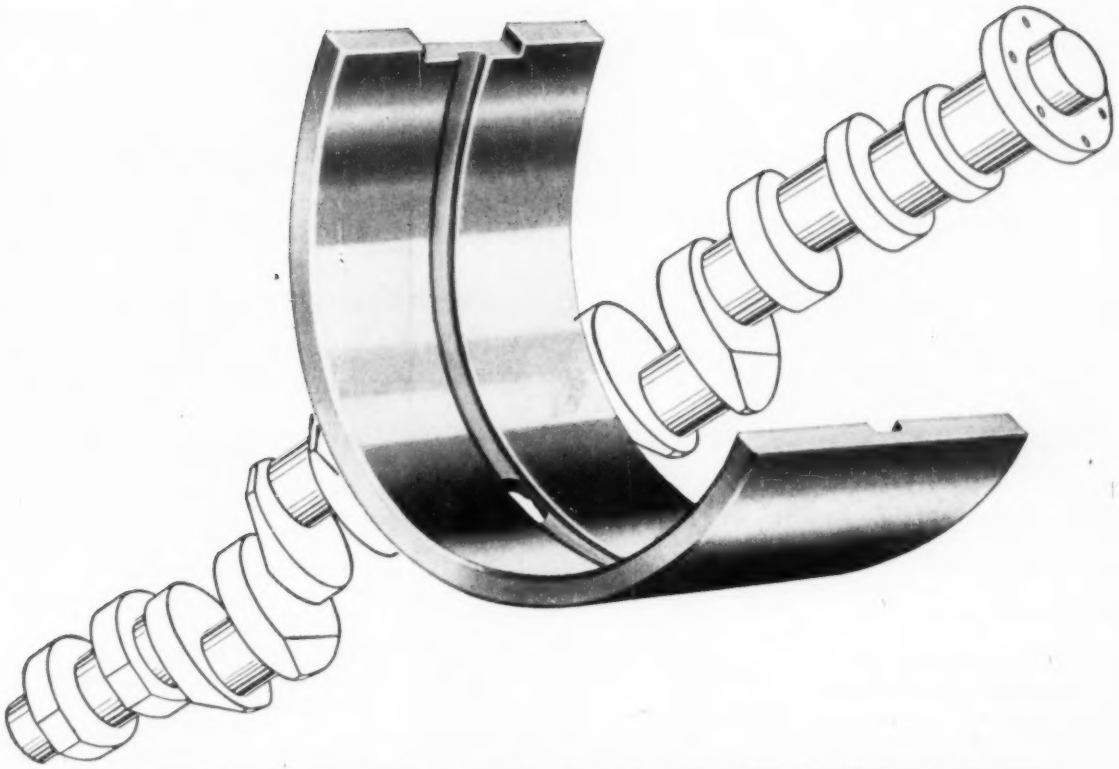
WORTHINGTON-BUILT AUXILIARIES

Balanced Angle Compressors

Oil Transfer Pumps

Cooling Water Circulating Pumps

Evaporative Type Engine Water Cooler



SHAFT HARDENING IS UNNECESSARY

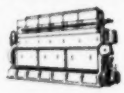
WITH FEDERAL-MOGUL *Federaloy B-40* COPPER-LEAD BEARINGS

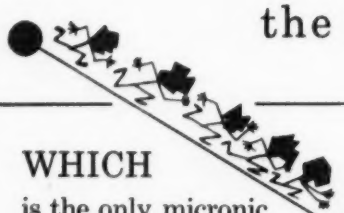
Through our special process for the production of cast copper-lead bearings we can now provide up to 40% lead content with excellent lead distribution. This means that you now can have a heavy-duty bearing combined with a soft shaft—and save the high cost of shaft hardening.

It also provides cast copper-lead bearings with high fatigue strength, imbedability and conformability characteristics. This type of bearing can "live" with a reasonable amount of unavoidable dirt in the engine and has excellent non-seizure properties.

Investigate the economies possible by eliminating shaft hardening and being able to combine a heavy-duty bearing with a soft shaft and much greater load-carrying capacity. Address: FEDERAL MOGUL CORPORATION, 11041 SHOEMAKER, DETROIT 13, MICHIGAN.

FEDERAL-MOGUL *Copper-Lead* DIESEL BEARINGS

Are YOU using the FILTER that advanced Filtration as much as the DIESEL  advanced the internal combustion engine?



WHICH

is the only micronic filter that works by a positive mechanical principle?

Cuno MICRO-KLEAN consists of a cartridge of fibres distributed under scientific control. It positively removes all injurious solids from Diesel fuel. Resinous-impregnated cartridge, unaffected by moisture, etc., won't soften, swell, harden, rupture or release contaminants to clog injectors or damage pump. (MICRO-KLEAN can be installed on suction side of pump.)

WHICH FILTER

needs the least amount of room?

Cuno MICRO-KLEAN cartridge is utterly simple. It's *all* filter—no structural components. This means less space needed—and makes *full-flow filtration* of lube oil a practical possibility.

WHICH FILTER

is guaranteed for specific performance?

Felting of fibres is accurately controlled for various densities . . . so that a Cuno MICRO-KLEAN of a given density will positively remove 100% of all solids for which it is rated, plus a large percentage down to 1 micron.

Diesel users will like . . .

Longer life—Exclusive "graded density in depth" permits smaller particles to penetrate to varying depths—doubles dirt-holding capacity.

No Channeling—Resinous impregnation and polymerization prevents channeling, rupturing, etc.

Low pressure drop

No removal of additives from lube

No danger of cartridge failure—Impervious to crankcase acids, moisture, other damaging agents.

Mail this coupon ***Investigate the Furthest Advance in Filtration of Diesel Fuel and Lube.***

Cuno Engineering Corporation
2518 South Vine Street
Meriden, Conn.

Please send me more facts on Cuno MICRO-CLEAN for Diesel services.

Name.....Title.....

Company.....

Address.....

City.....State.....

PLEASE ATTACH COUPON TO YOUR BUSINESS LETTERHEAD

NO FLUID IS BETTER THAN ITS FILTRATION

CUNO

Complete Line Fluid Conditioning

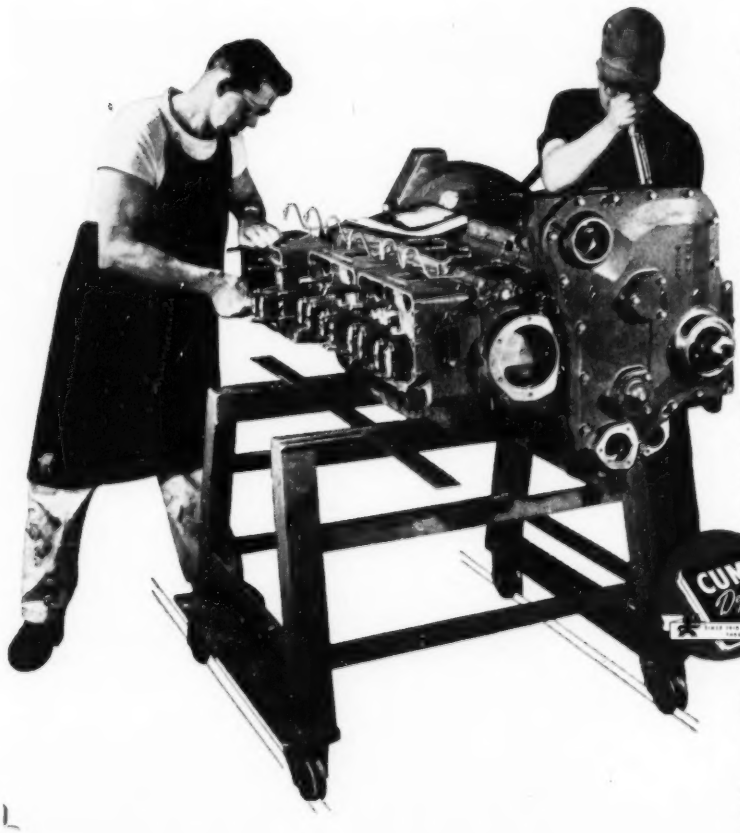
Removes More Sizes of Solids from More Types of Fluids

MICRONIC Micro-Klean • DISC-TYPE Auto-Klean • WIRE-WOUND Flo-Klean

Cummins® Custom-built Diesels

Built not once but Twice

Extra care in building means extra profits for power users



Typical of the extra care that goes into the building of *every* rugged, dependable Diesel is the tear-down of the engine after assembly. First the engine is run in on the test block. Then it is completely torn down and carefully re-inspected. After that it is re-assembled and tested *again*.

Such *extra* care in precision craftsmanship is one of the reasons why Cummins engines have such an outstanding record in a wide range of applications. Cummins exclusive fuel system . . . world-wide service and parts supply organization . . . are other features that enable power users to make more profit with Cummins Diesels.

There's a model engineered to fit your power needs. Contact your Cummins dealer. He has more facts to show you.

CUMMINS Dependable DIESEL

Diesel power by CUMMINS

TRADEMARK REG. U. S. PAT. OFF.

CUMMINS ENGINE COMPANY, INC. • COLUMBUS, IND.

EXPORT: CUMMINS DIESEL EXPORT CORPORATION
Columbus, Indiana, U. S. A. • Cable: Cumdiex

Lightweight High-speed Diesel Engines (50-550 hp) for: On-highway trucks • off-highway trucks • buses • tractors • earth-movers • shovels • cranes • industrial locomotives • air compressors logging yarders and loaders • drilling rigs • centrifugal pumps generator sets and power units • work boats and pleasure craft.

TONS OF TOUGHNESS MOVED WITH FLEXIBILITY

Penflex Tubing Moves Abrasive Copra

Provides Flexibility . . . Absorbs Vibration . . . Withstands Abrasion

When tough copra, the dried kernel of the cocoanut, moves through pneumatic conveyors . . . ordinary tubes wear out. Where copra is unloaded, tubing must be flexible to accommodate changing levels and positions of the conveyor and cargo.

The answer was found in Penflex tubing installed by Penflex Engineers. Lengths of full interlocking galvanized steel flexible #20 heavy duty hose (8" and 10" I.D.) were installed. It answered every requirement—provided flexibility for free movement of hose in hold, absorbed vibration from machines, took up movement of ship due to tide changes.

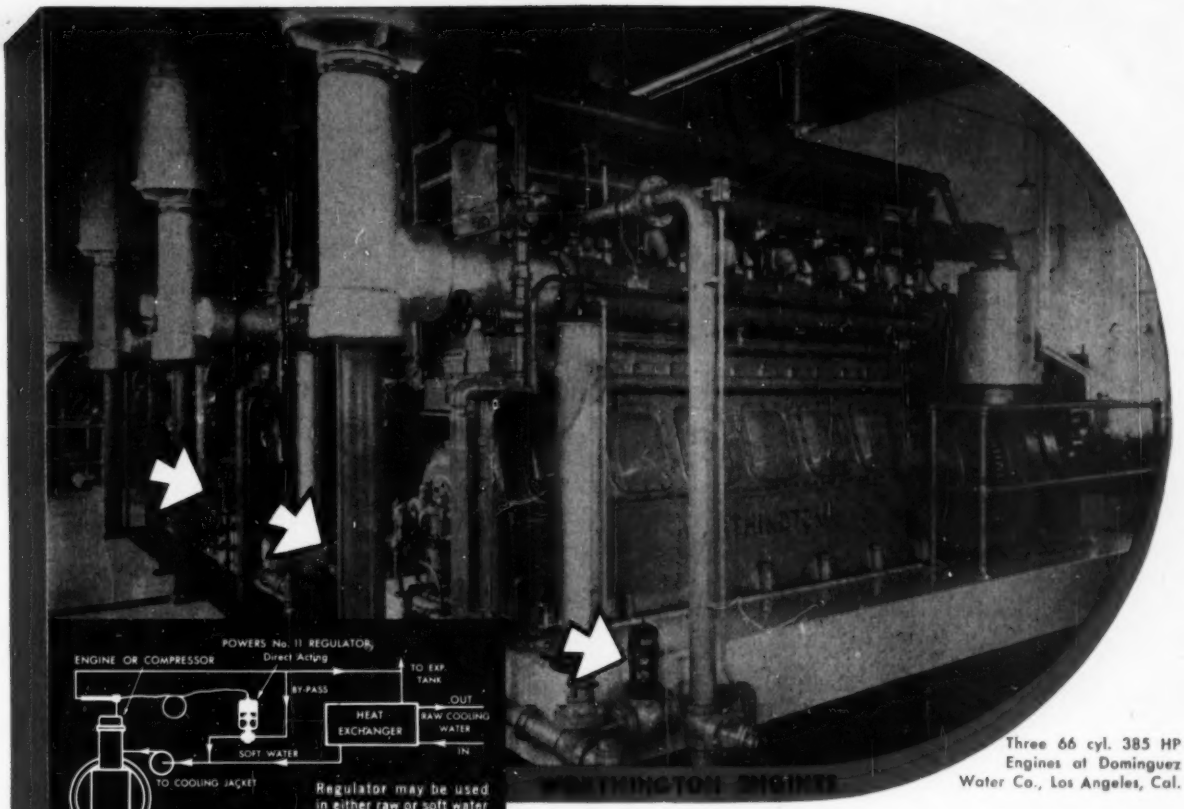
You may not have a problem involving pneumatic conveyors, but if it pertains to flexible tubing, Penflex Engineers have the answer. As America's oldest manufacturer of flexible hose, Penflex offers helpful layout-design service on flexible tubing applications to all industries. For flexible metallic hose, tubing, or couplings from 1/8" I.D. and up . . . for handy, time-saving automatic barrel fillers and pneumatic rivet passers . . . for the finest in engineering service, call on Penflex. Write for your copy of "FLEXINEERING AT WORK TODAY."

Pennsylvania Flexible Metallic Tubing Company, Inc.
7236 Powers Lane, Philadelphia 42, Pennsylvania

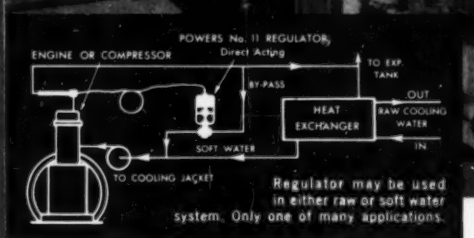
Branch Sales Offices

BOSTON • NEW YORK • CHICAGO • HOUSTON • CLEVELAND • LOS ANGELES

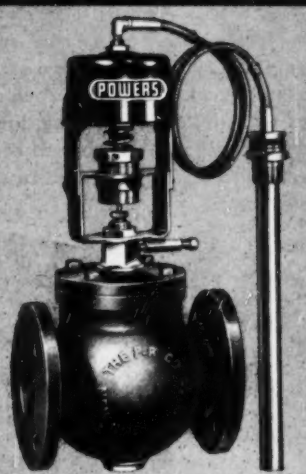
penflex... HEART OF INDUSTRY'S LIFE LINES



Three 66 cyl. 385 HP Engines at Dominguez Water Co., Los Angeles, Cal.



Regulator may be used in either raw or soft water system. Only one of many applications.



Powers No. 11 Self-Operating Temperature Regulator for jacket water or lube oil control. Available direct or reverse acting, or 3-way valve. Sizes ¼" thru 2" have bronze double union valves; sizes 2½" thru 8" have flanged iron bodies. Pneumatic controls also available.

POWERS

TEMPERATURE CONTROL

End Danger of Cracking Pistons, Cylinder Heads and Sludging, with POWERS Thermostatic Control

Regulate jacket water and lube oil temperatures automatically with POWERS control. Regardless of load or seasonal changes Powers Regulators hold the temperature just where you want it. They prevent *over*heating and *over*cooling.

Accurate Temperature Control—insures better lubrication, longer cylinder liner wear, fewer piston ring replacements, prevents danger of piston seizure, reduces fuel and lube oil consumption.

Powers Control Costs Less than a set of new piston rings. Often pays back its cost the first year. It's economical, reliable, gives many years of dependable service.

Have a Powers Engineer Call to study your requirements for better temperature control. With both *self-operated* and *pneumatic controls* plus many years of experience we may be able to help you select the type that will give best results. There's no obligation. THE POWERS REGULATOR CO., *Established 1891 • Offices in Over 50 Cities • See Your Phone Book.*

New York 17, N. Y., 231 E. 46th St. • Los Angeles 5, Cal., 1808 West 8th St.
Toronto, Ont., 195 Spadina Ave. • Mexico, D. F., Edificio "La Nacional" 601

(D-11A)

The Powers Regulator Co., 2710 Greenview Ave., Chicago 14, Illinois

Have engineer call to study our requirements for better jacket water temperature control.

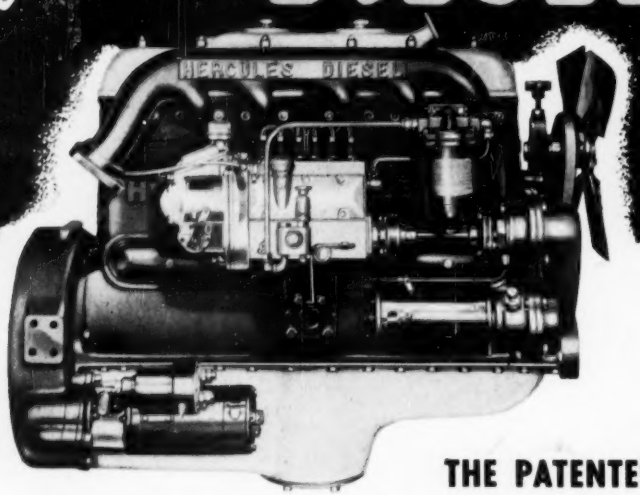
Name of Engine or Compressor ..... HP .....

Your Name .....

Address .....

City ..... State .....

Operating economy starts with HERCULES DIESEL ENGINES



THE PATENTED HERCULES COMBUSTION CHAMBER!

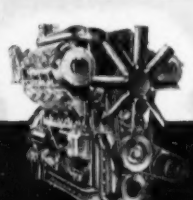
The universal acceptance of Hercules lightweight, high-speed, heavy-duty diesel engines is reflected in the sound engineering and outstanding design characteristics of the Hercules patented combustion chamber. It is designed to greatly increase the velocity of the air passing into the combustion chamber. When the air velocity reaches its maximum—fifty times crankshaft speed—the fuel is injected. This assures the complete mixing of the fuel and air, complete combustion at the right time and at the proper rate of burning. This results in: the highest possible expansion of the burned gases . . . exceptionally high operating efficiency . . . low fuel consumption—(since all fuel is completely burned) . . . clean exhaust . . . a minimum of smoke and noise. To install Hercules diesel engines is to secure the full benefits of the Hercules patented combustion chamber.

Hercules diesel engines are built in a broad range of sizes and displacements, from 12 to 500 horsepower, with automotive type of mounting or as enclosed, open or base type power units. They are parallel in mounting dimensions and performance with Hercules gasoline engines of similar displacement. Call in a Hercules engineer to discuss your future diesel power requirements.

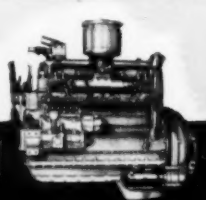
Model	Bore and Stroke Inches	Piston Displ. Cubic Inches
TWO CYLINDER DIESEL		
DIXC	4″ x 4 1/2″	113.1
DIXD	4 1/4″ x 4 1/2″	127.5
FOUR CYLINDER DIESEL		
DIX4B	3 1/4″ x 4″	133
DIX4D	3 5/8″ x 4″	166
DOOB	3 3/4″ x 4 1/2″	198.8
DOOC	4″ x 4 1/2″	226.2
DOOD	4 1/4″ x 4 1/2″	255
SIX CYLINDER DIESEL		
DJX6D	3 5/8″ x 4″	248
DJXB	3 1/2″ x 4 1/2″	260
DJXC	3 3/4″ x 4 1/2″	298
DJXH	3 3/4″ x 4 1/2″	298
DJXHF	3 3/4″ x 4 1/2″	298
DWXC	4″ x 4 3/4″	358
DWXCF	4″ x 4 3/4″	358
DWXD	4 1/4″ x 4 3/4″	404
DWXDF	4 1/4″ x 4 3/4″	404
DWXLD	4 1/4″ x 5″	426
DWXLDF	4 1/4″ x 5″	426
DRXB	4 3/8″ x 5 1/4″	474
DRXC	4 5/8″ x 5 1/4″	529
DFXB	5″ x 6″	707
DFXC	5 1/4″ x 6″	779
DFXD	5 1/2″ x 6″	855
DFXE	5 5/8″ x 6″	895
DFXH	5 3/4″ x 6″	935
DFXHF	5 3/4″ x 6″	935
EIGHT CYLINDER DIESEL		
DNXV-8B	5 3/4″ x 6″	1247
DNXV-8C	6″ x 6″	1348
DNXV-8D	6 1/4″ x 6″	1468
DNXV-8DS	6 1/4″ x 6″	1468

OUTSTANDING ADVANTAGES

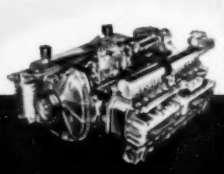
- TOP OPERATING ECONOMY
- PROVEN PERFORMANCE
- LONG LIFE SERVICE
- SMOOTH FLEXIBLE POWER
- LOW MAINTENANCE
- HIGH-SPEED HEAVY-DUTY SERVICE



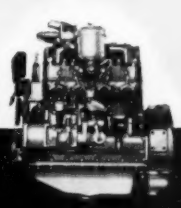
Model DNXV-8 Eight Cylinder Vee Type



Model DIX6D Six Cylinder



Model DFXHF Six Cylinder Pancake Type



Model DIX4D Four Cylinder

HERCULES MOTORS CORPORATION • *Canton, Ohio, U.S.A.*

This Exide Battery is cranking thousands of your engines, Mr. Diesel

When your engines first came into general use, Mr. Diesel, its high compression ratio made cranking a major problem. Exide engineers solved it by building a battery designed specifically for the job.

To engine builders . . . and manufacturers of Diesel-powered equipment . . . and users of Diesel engines . . . this means: When an Exide does the cranking, your engines START.

You can count on a *quick breakaway, high cranking speeds, low voltage drop.*

You can count on trouble-free performance . . . in rugged service . . . in all climates.

You can count on long battery life and low cost maintenance . . . proved daily in buses, trucks, trailer tractors, off-the-highway equipment, ships, power plants, Diesel-electric locomotives.

For dependable service at a saving, use Exide Diesel-cranking Batteries.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32
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WHATEVER YOUR CRANKING PROBLEMS
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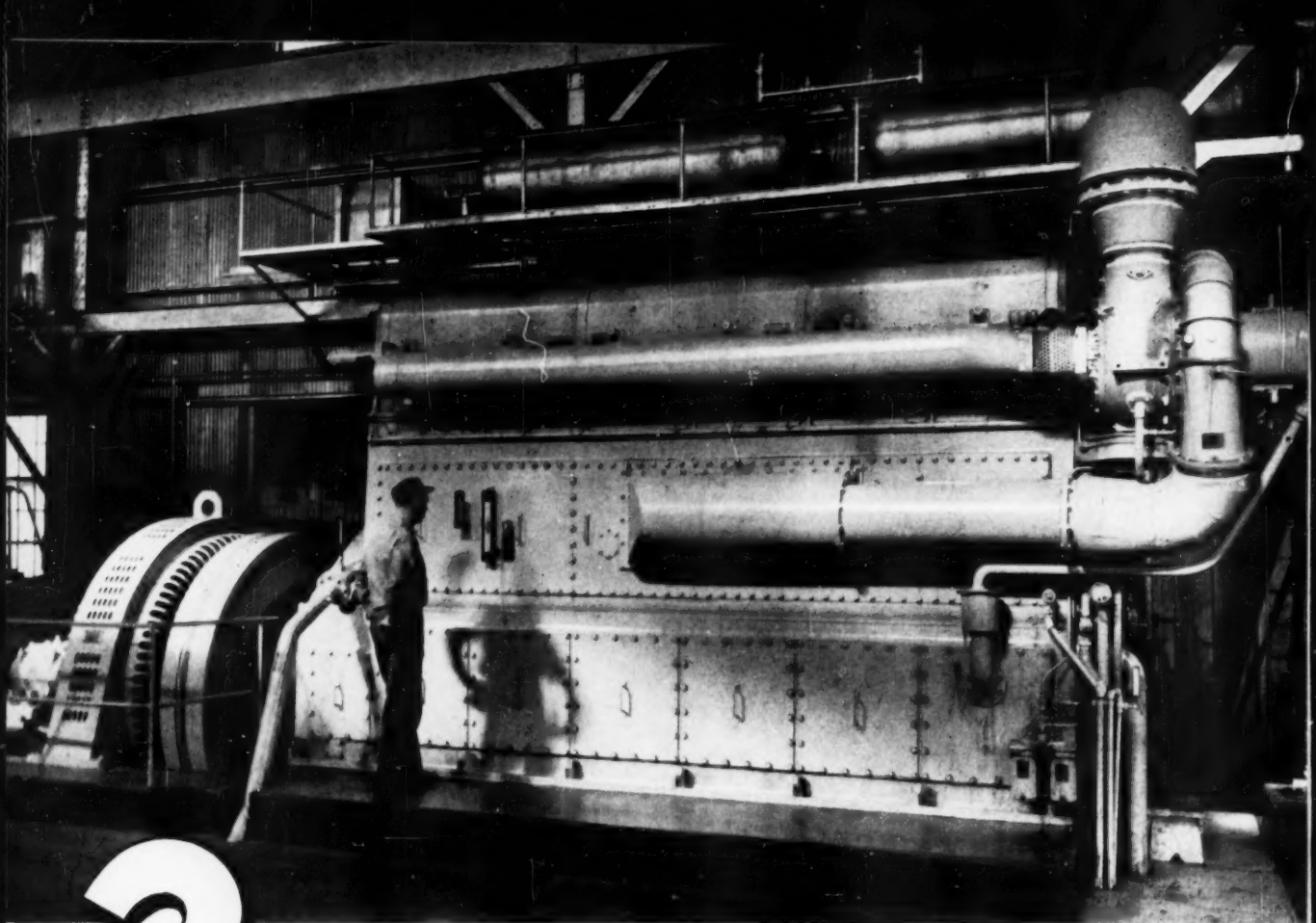


3rd NORDBERG for Miami plant of ARIZONA EDISON CO., INC.

. . . purchased as a result of the excellent performance of their first two engines

EARLY in 1948, the Arizona Edison Co., Inc. installed this Nordberg Duafuel Diesel Engine in their Miami, Arizona, plant . . . a 6-cylinder, 4-cycle supercharged unit having a sea level rating of 1220 hp at 327 rpm, driving an 800 kw AC generator. In 1949, a second Nordberg Duafuel Engine was installed . . . an 8-cylinder 1750 hp supercharged unit, driving a 1235 kw AC generator.

These first two Nordberg Duafuel Engines were operated "around the clock", and, because of their excellent performance, a third Nordberg Duafuel unit has now been purchased . . . identical to the second engine installed.

Here, then, is *repeat order proof* that Nordberg Duafuel Diesels deliver the kind of dependable performance you need for central station service. Write for details on Nordberg engines to meet your needs . . . sizes from 10 to 9600 hp.

NORDBERG MFG. CO., Milwaukee 7, Wis.

P850

BUSCH-SULZER A DIVISION OF NORDBERG

NORDBERG DIESEL ENGINES

ALMOST KILLED THE GOOSE!

Diesel liners get some mighty destructive treatment. So did Mexico, under Hernando Cortez.

For three years, he rode rough-shod over the Aztecs, massacring them and tearing down their cities to get his hands on more and more treasure.

Yet even the old Spanish conquistador finally saw that to keep it up would kill the goose — and leave him fresh out of golden eggs. So, in 1521 he began restoring all the damage.

Yes, that restoration paid him handsome profits—just as PORUS-KROME* and VANDERLOY M pay Diesel users. They are particularly glad now — with replacement parts in critical supply—to have long-wearing PORUS-KROME liners, that can be renewed almost indefinitely.

As for engine parts already made useless by the practice of remachining their bearing diameters — well, even junk liners — and *crankshafts* too — are restored to original dimensions with VANDERLOY M. It gives them a longer service life than new ones. And each restoration costs as little as the first.

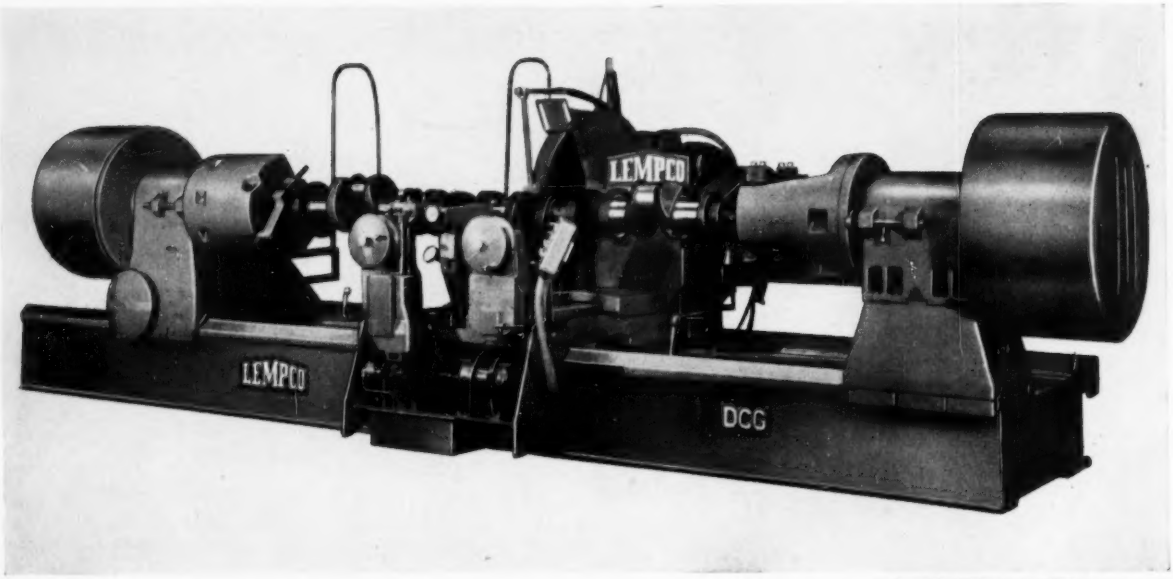
**PORUS-KROME is dense, hard, wear and corrosion-resistant chromium applied by the exclusive Van der Horst process which gives working surfaces an infinite number of tiny oil-resisting reservoirs for perfected lubrication.*

VAN DER HORST CORPORATION OF AMERICA • OLEAN, N. Y.

U. S. PATENTS 2,048,578, 2,314,604 and 2,412,698

PORUS - KROME VAN DER HORST

Cortez for the Life of Your Engine



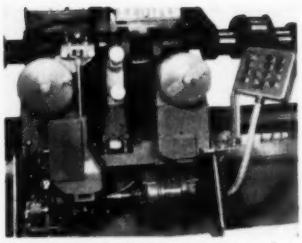
DIESEL CRANKSHAFT GRINDER with the traversing wheelhead *reduces initial investment by 2/3*

The new Lempco Supersize series of Diesel Crankshaft Grinders are approximately half the length of the other big shaft grinders. Yet Lempco machines equal or better the capacities of other makes.

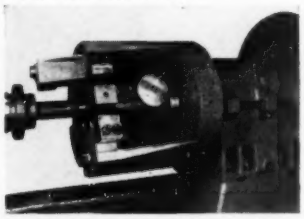
This is made possible by utilizing the same principle Lempco introduced on standard size automotive crankshaft grinders—that of moving the grinding wheel from journal to journal, instead of moving the shaft along the wheelhead.

By combining this savings in overall size with further economies in use of heavy welded steel base, Lempco is able to offer a precision grinder that incorporates more than 20 years of experience in building automotive crankshaft grinders. Write for Bulletin on Diesel Crankshaft Grinder.

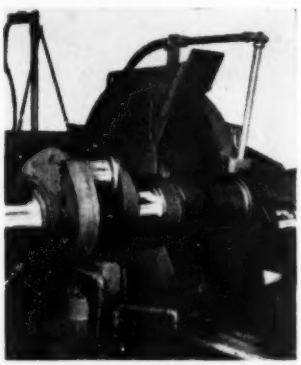
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio



Control panel of the six motors that control the traverse, speed and hydraulic mechanism that operate the diesel crankshaft grinder.



Pot chuck set up to grind main bearings between centers. When crank pins are ground shaft is held inside of chuck.



Showing relative size of grinding wheel and diesel shaft. Coolant floods wheel at point of contact with work.

PRECISION-SPEED . . . . FOOLPROOF OPERATION

- Hydraulic traverse and infeed of grinding wheel.
- Fine adjustment of grinding wheel made by manual micrometric dial.
- Push-button foolproof control. Automatic Safety Controls.
- Low center of balance offers maximum machine rigidity. Work is ground at operator's eye-level.
- Three models: RCG takes 32" swing and 108" length; DCG takes 40" swing and 178" length; SCG takes 50" swing and 216" length, larger size built to specifications.
- Built on a principle proven by 20 years of production "know-how" in precision machinery manufacturing.

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STANDARD ENGINEER'S REPORT

DATA

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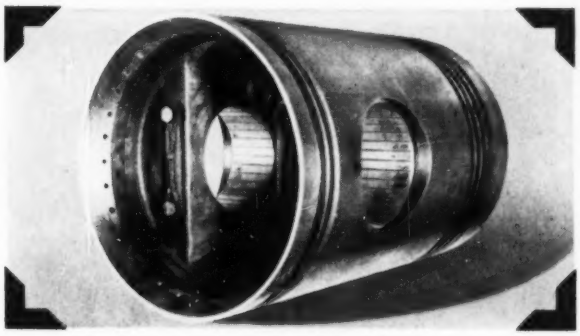
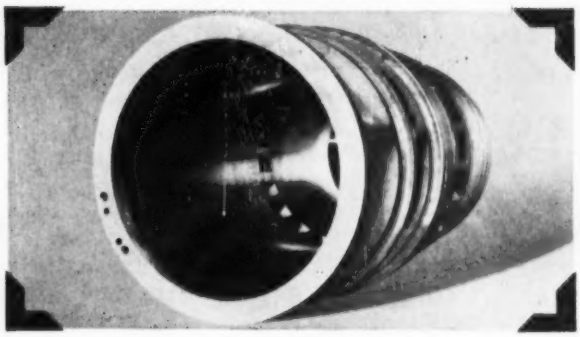
UNIT Diesel Locomotive cylinder assembly
SERVICE Mountain Freight
LOCATION Transcontinental freight service on Moffat tunnel & Royal Gorge Routes
PERIOD In excess of 8 years
FIRM Denver & Rio Grande Western R.R.Co.

One million miles of service on cylinder liners and pistons





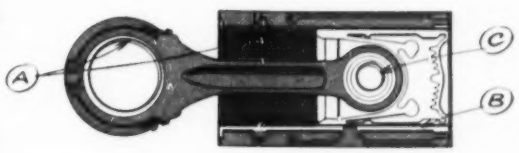
IN SERVICE APPROXIMATELY 1,000,000 MILES in Denver & Rio Grande Western Railroad diesel locomotive engines, this piston and cylinder liner were always lubricated with RPM DELO Oil R.R. At the end of that time wear measurements (inches) were only: Piston Skirt—0.001; Ring Grooves—No. 1—0.003 to 0.006, No. 2—0.002, No. 3 & 4—none; Cylinder liner (maximum diameter)—0.0095, (out of round)—0.002 to 0.004.

RPM DELO Oil R.R. has been the standard on the Denver & Rio Grande Western Railroad for over-the-road freight and passenger locomotives since their first power of this type was placed in service in January 1942. At the time this inspection was made approximately 49,563,104 miles had been traversed by the Rio Grande freight diesel fleet of 100 units and during that period only 77 cylinder liners had been scrapped for any reason. At that time many of the original pistons and cylinder liners were still in service and the average age of all these assemblies, including recently purchased power, was 4.7 years.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM" REG. U.S. PAT. OFF.

How RPM DELO Oil R. R. prevents wear, corrosion, oxidation



A. Special additive provides metal-adhesion qualities...keeps oil on parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean... helps prevent scuffing of cylinder walls.

C. Special compounds stop corrosion of any bushings or bearing metals and foaming in crankcase.

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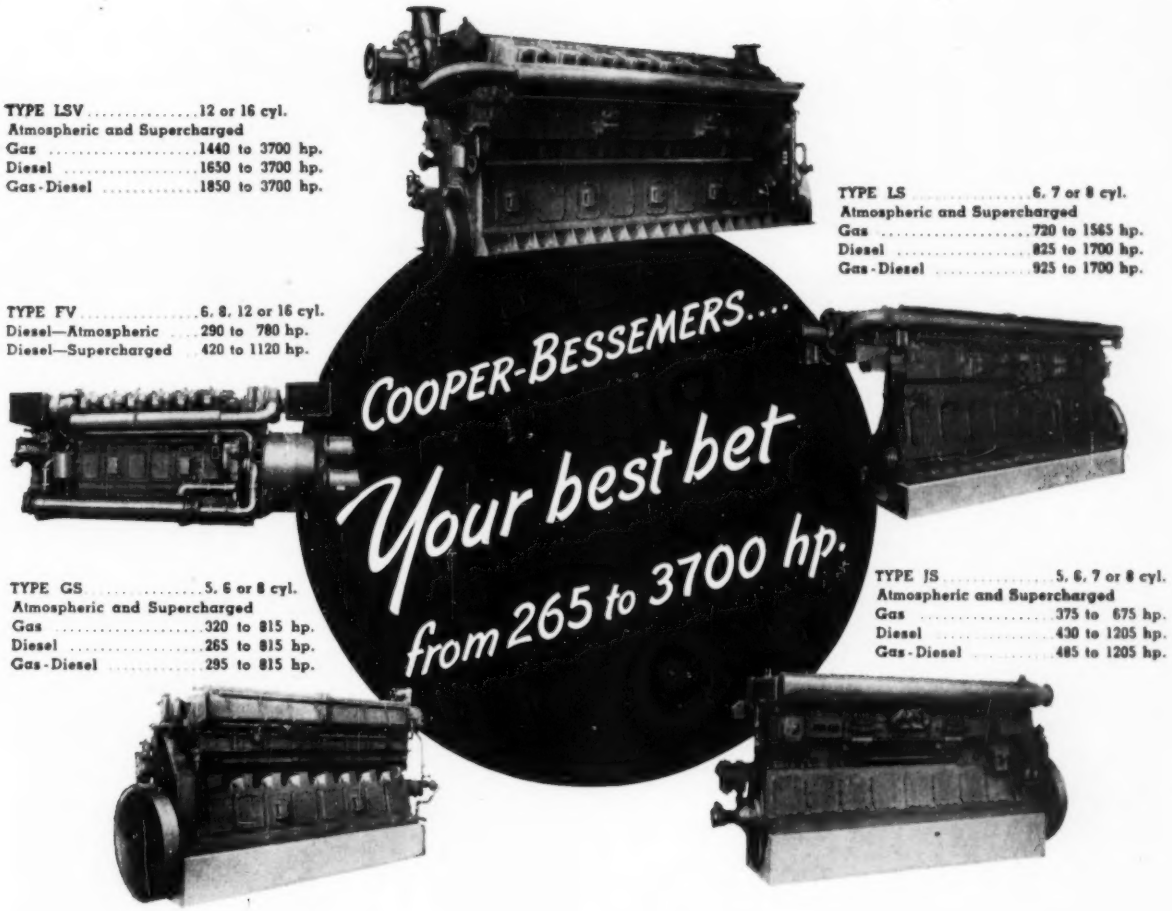
THIS IS AN ANNUAL ISSUE

After April, none will be available until 1952. It is not only our most popular number — It is the most useful and, to most diesel men, the indispensable number.

Mail the Coupon


TYPE LSV ..... 12 or 16 cyl.
Atmospheric and Supercharged
Gas ..... 1440 to 3700 hp.
Diesel ..... 1650 to 3700 hp.
Gas-Diesel ..... 1850 to 3700 hp.
TYPE LS ..... 6, 7 or 8 cyl.
Atmospheric and Supercharged
Gas ..... 720 to 1585 hp.
Diesel ..... 825 to 1700 hp.
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TYPE FV ..... 6, 8, 12 or 16 cyl.
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COOPER-BESSEMERS....
Your best bet
from 265 to 3700 hp.
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Atmospheric and Supercharged
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Diesel ..... 265 to 815 hp.
Gas-Diesel ..... 295 to 815 hp.
TYPE JS ..... 5, 6, 7 or 8 cyl.
Atmospheric and Supercharged
Gas ..... 375 to 675 hp.
Diesel ..... 430 to 1205 hp.
Gas-Diesel ..... 485 to 1205 hp.

Pictured above are Cooper-Bessemer stationary engines of five different types, all thoroughly work-proved, all offering the peak efficiency, long life and low maintenance for which Cooper-Bessemers are so well known. Note the horsepower ratings given. These are the latest ratings as influenced by refinements in design as well as new or improved operational features. And, as also indicated, you have a choice of oil, gas-diesel or full gas operation, atmospheric or supercharged, whichever is to your greatest advantage.

Above all, these Cooper-Bessemers are rugged, work-wise engines if there ever were any. From oil sumps to cylinder heads they are engineered to help you produce the power you need at the lowest possible cost.

If your plans call for new or replacement power, check with the nearest Cooper-Bessemer office. Be sure to get all the facts on the distinctive features that pay off for Cooper-Bessemer users time and time again.

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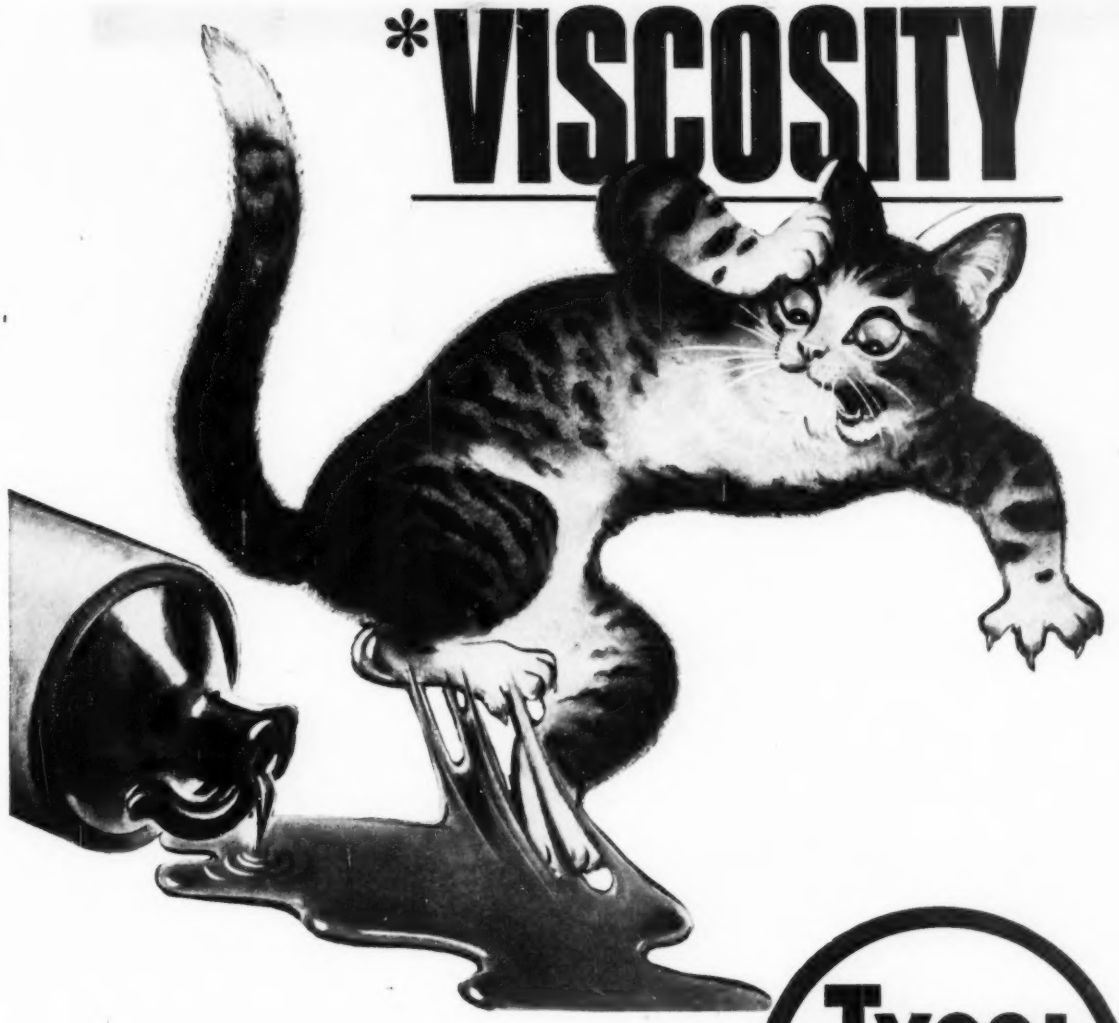
DELCO-REMY • WHEREVER WHEELS TURN OR PROPELLERS SPIN

*VISCOSITY



All equipment will last longer — give better service — if you use the proper lubricant. That's why you'll find it profitable to use Tycol high quality oils and greases.

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WITH DETACHABLE, REUSABLE FITTINGS

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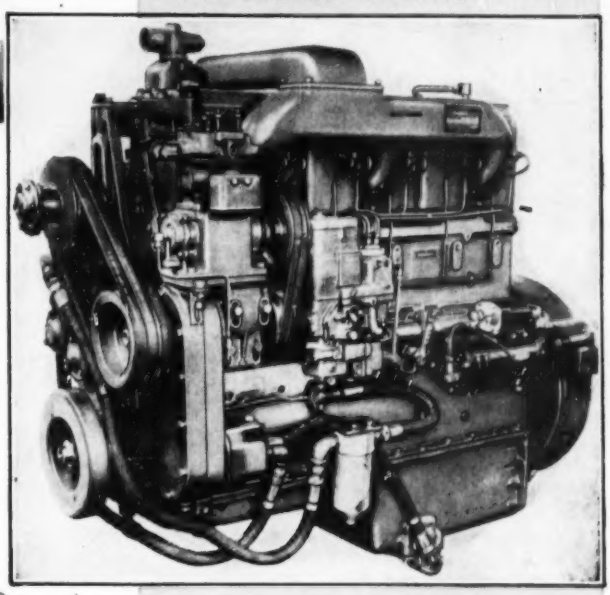
Always first
ON DIESEL ENGINES



Save time, save money and reduce inventory by putting the "Aeroquip Idea" to work for you. With Aeroquip you make your own flexible hose assemblies by cutting bulk hose to desired lengths and attaching Aeroquip Reusable Fittings. Assembly can be accomplished quickly and easily right on the job. No special tools are required. No training is needed. Aeroquip high quality Flexible Hose Lines improve performance and reduce maintenance. They eliminate leaks due to vibration and operate dependably at extremely high or low temperatures. They are widely used for hydraulic fluid, water, air, lubricating oils, gas and Diesel fuels and many other fluids.

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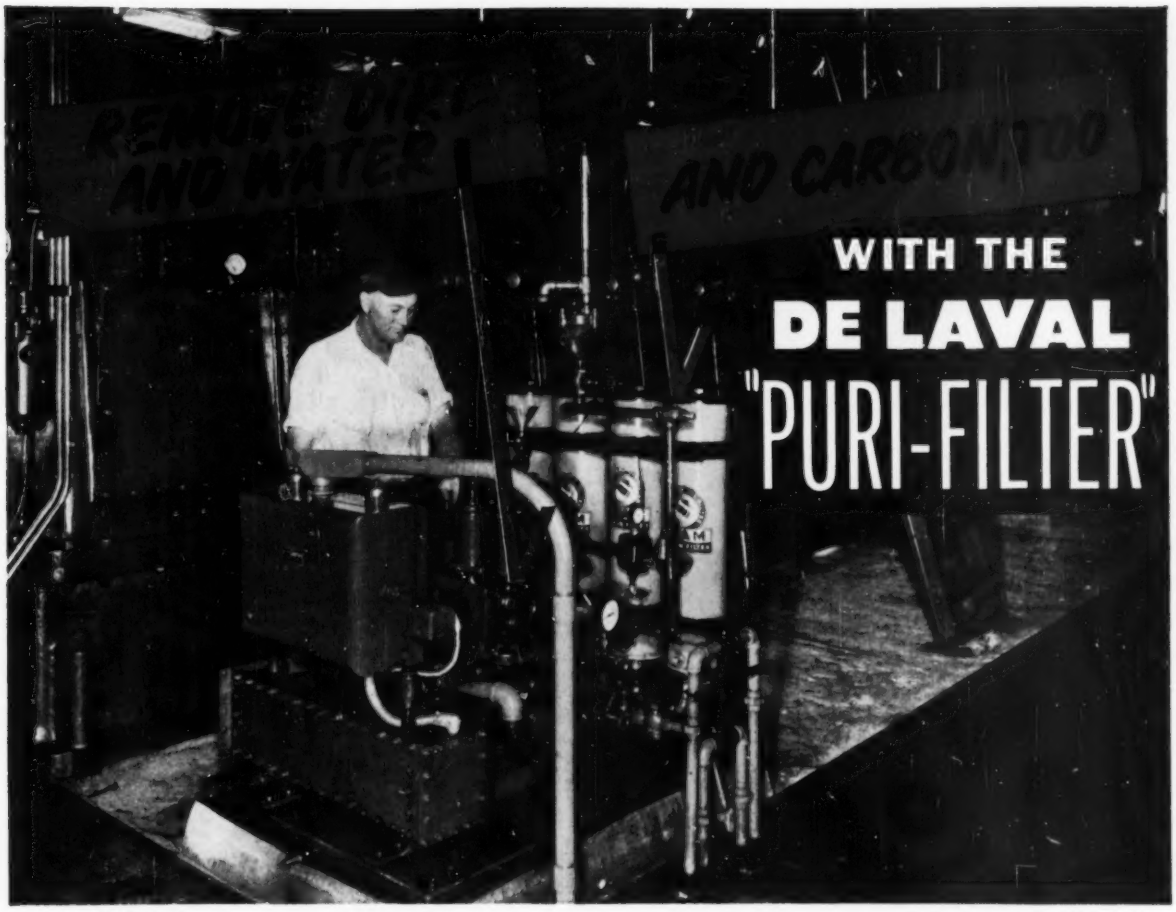

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- Write for additional details on the De Laval "Puri-Filter" for diesel lubricating oil. Ask for Bulletin DL-1.

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Such constant protection reduces maintenance time and expense to a minimum—increases efficiency and operating economy. Alnor Pyrometers are low cost, easy to install on old or new engines. Ask your Alnor Representative to assist you in selecting the right equipment from the full line of Alnor Exhaust Pyrometers and special thermocouples. Illinois Testing Laboratories, Inc., Room 507, 420 N. LaSalle St., Chicago 10, Illinois.

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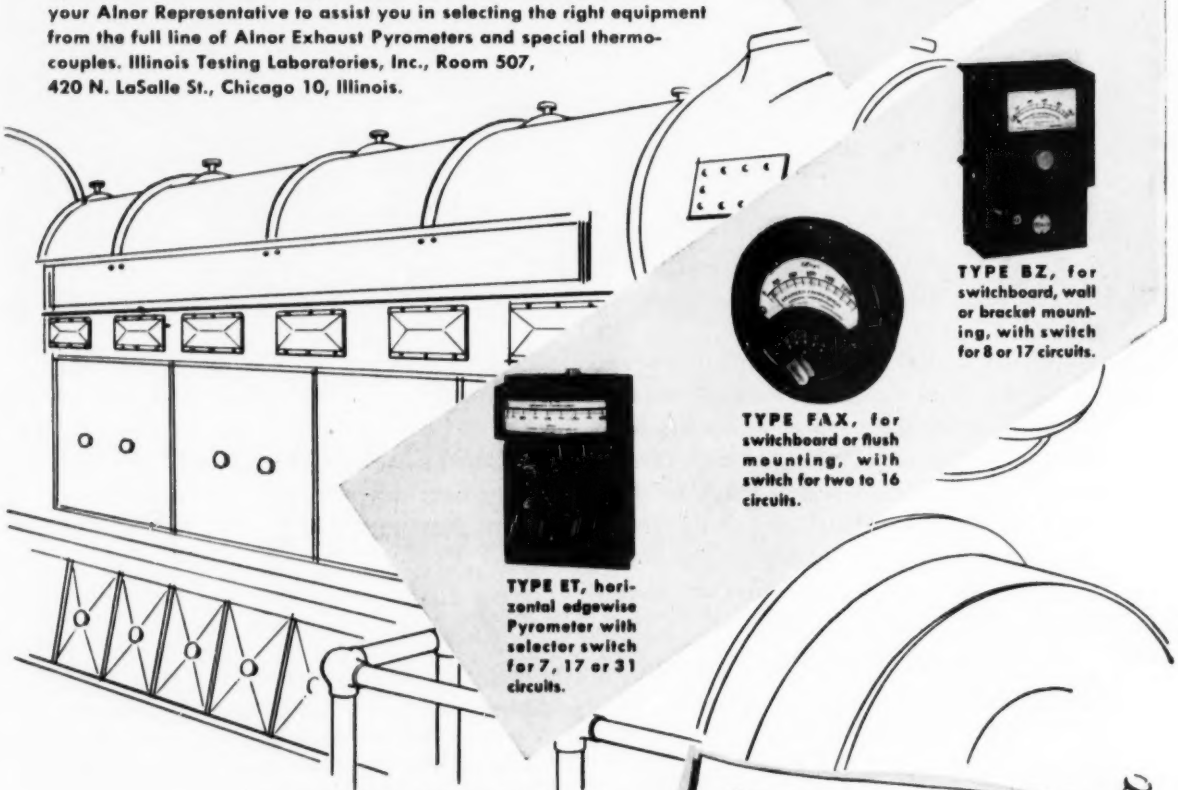
TYPE BZ, for switchboard, wall or bracket mounting, with switch for 8 or 17 circuits.

TYPE FAX, for switchboard or flush mounting, with switch for two to 16 circuits.

TYPE ET, horizontal edgewise Pyrometer with selector switch for 7, 17 or 31 circuits.



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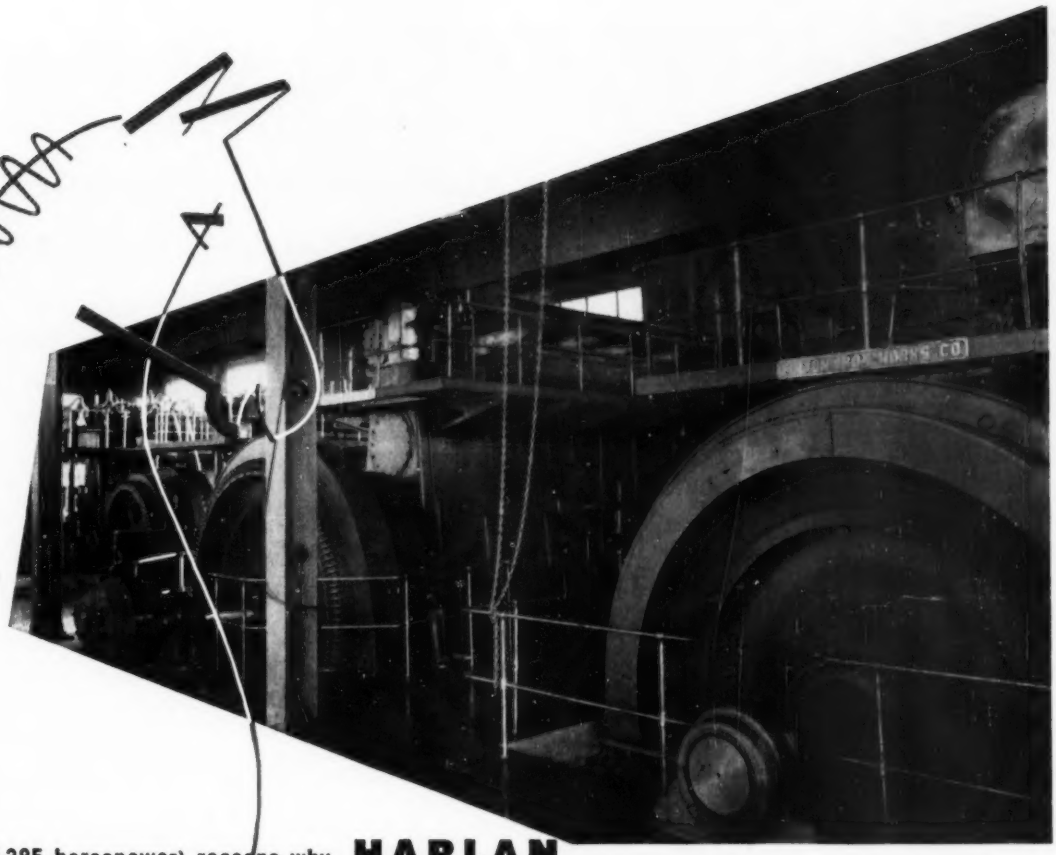

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knows it's "horse sense" to standardize on

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Since 1929, the Harlan, Iowa, municipal plant has installed six diesels totalling 8,385 h. p. — 100% FULTON.

The newest, a 2,760 h. p. 6-cylinder Type KSS, shown in the foreground above, went into service just a year ago. Already it has set a remarkable record of fuel economy: 14.01 K. W. at loads varying from 57 to 70 % of capacity.

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The anti-flutter feature of the Cook 124 ring has made it possible to use a material of proven wear resistance — Cook Graphitic Iron — as contrasted with ordinary rings made of high modulus materials.

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Diesel Power
and DIESEL TRANSPORTATION

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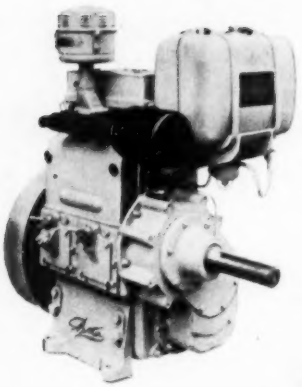

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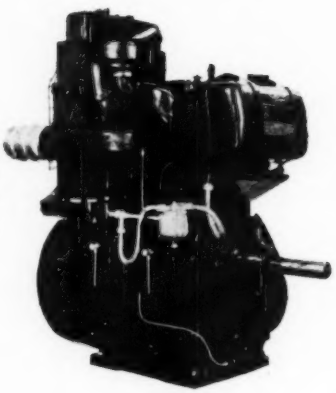

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Editorial:

Internal Combustion Engines for Aluminum Production

ANY stray doubts as to whether aluminum is one of the major requirements of a re-armament program should be set at rest by recent announcements. It is needed and needed badly in quantities far beyond the capacity of production facilities adequate for more normal times.

The industry, in common with many others, anticipated any official action by imposing voluntary controls. Now, announcement is made that existing facilities are to be expanded. All this would appear to be a golden opportunity for those engaged in building large internal combustion engines.

While it is true that military necessity comes before cost, there is no reason why the demonstrated economy and suitability of such engines for aluminum production should not be a major factor in power selection.

The electrolytic reduction process requires large amounts of dc. power. The cheaper the power, the cheaper the cost of the refined product. Hydro power is probably the least expensive when available and consistent. Internal combustion engines operating in low cost fuel areas are the next choice.

During the past war, several government plants were erected in high-cost power areas as a military expedient. These have been idle of recent years since the power cost rendered the final product non-competitive from the price angle. Alcoa has announced that they will reopen two such plants (again, as an expediency) in Massena, N. Y., and Badin, N. C., to meet rising military requirements.

The three aluminum producers, Alcoa, Reynolds and Kaiser, have announced their intentions to build additional plants and the first two, to expand their present facilities as well. This expansion will take place at the two largest internal combustion plants in the world, Alcoa's Point Comfort, Texas, plant and the Reynold's Jones Mill plant in Arkansas.

The first of these was built by the government and operated by Alcoa during the last war and this experience apparently inspired the development program in cooperation with Nordberg that resulted in the radial type engines used in the new Point Comfort Plant. This new plant construction and the continued operation by Reynolds of the older plant indicates that they were found to be efficient and economic.

Actual power cost figures for these plants are not available but knowing the approximate fuel consumption of the engines involved and fuel costs in the areas, it is not difficult to estimate power costs — and they are low.

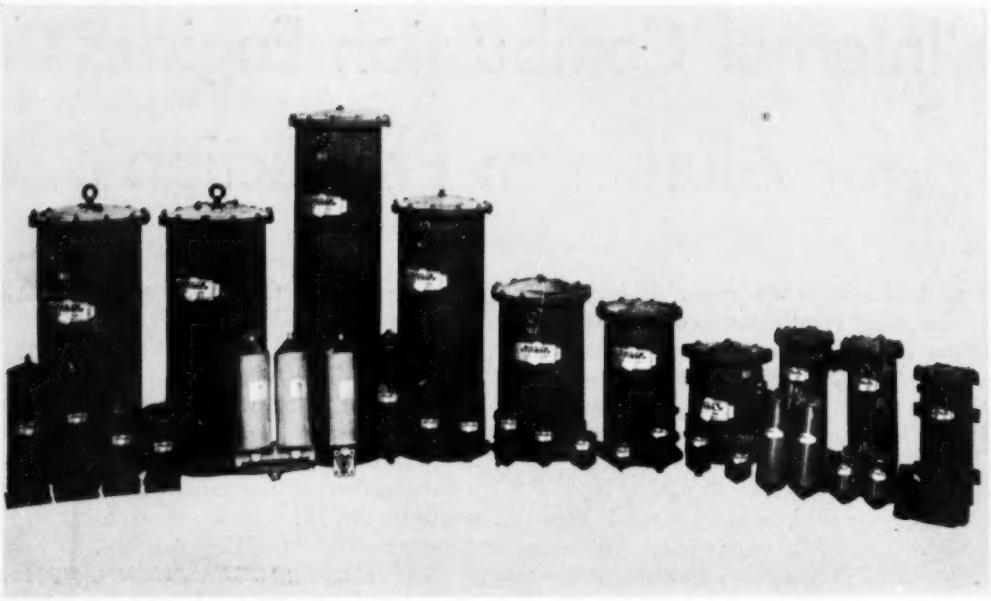
It is safe to assume that the plant expansion mentioned will utilize internal combustion engines for obvious practical reasons. However, of the three new plants projected, it is reported that at least one will be steam powered.

Why? Internal combustion engine plants have demonstrated their ability to do the job effectively and cheaply. Three types of engines are curently employed and there are many others that are suitable and good. It would not appear that a shortage of engines is a stumbling block.

The old argument of the complication of multi-engine installations does not apply here. Aluminum men have pointed out the necessity for continuity of operation: Once a pot line is started, any unforeseen interruption of power is costly. This is assured in the two leading plants by the use of a number of engines of such horsepower that even if a reasonable percentage should fail, the balance can carry the load. Large high pressure and temperature turbines, pre-supposed for efficiency, would not afford similar flexibility of operation.

Many factors affect plant location; man power, transportation facilities, etc. Proximity to cheap fuel for elimination of transportation costs is a big item. Suitable and adequate water is a necessity for a steam plant. All these must be considered and some will, upon analysis, influence the choice of power.

Gas burning internal combustion engines seem to be the best answer. Undoubtedly, many will be used in the present program. Why not go the "whole hog" and build today for the future on the basis of existing plants known to be economically sound.



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+ HIGHLIGHTS +

● Railroads installed 1932 new locomotives in the first ten months of this year, almost all of them diesels.

● In November, the GMC Truck and Coach Division produced 9916 vehicles, including diesel trucks and buses.

● The annual convention of the Automotive Engine Rebuilders Association will be held at the Hotel Sherman, Chicago, May 7, 8, and 9.

● During the past year, platinum found extensive use in the production of small glow plugs for starting miniature diesel engines in model aircraft.

● Since it was started two years ago, the output of the EMD plant in Cleveland has quadrupled, and is now producing four locomotives per day.

● Allis-Chalmers recently announced that it had shipped "the world's first coal-burning locomotive gas turbine" to Dunkirk, N.Y.

● Advanced principles of machining high temperature alloys are contained in a report just released by the Air Material Command at Dayton, Ohio.

● Equipment purchases of the railroads were five times greater during 1950 than in 1949, according to R. H. DeMott, president of SKF. Much of this equipment was diesel locomotives.

● Highway systems of the 48 states won't meet the demand of 1950's traffic for an average of 16 more years at the current rate of road construction expenditures, according to the American Road Builders' Association.

● In a paper presented at an SAE National Fuels and Lubricants Meeting, the Navy reported that tests of diesel fuel additives over the past 15 years indicate that in some cases a cetane boost of 20 or more has been obtained with 1.5 per cent dope.

● The AIEE will hold its annual summer meeting June 25-29 in Toronto.

● The New York Central has ordered 27 diesel switchers from the Lima-Hamilton Corp. The order covers an expenditure of $2,400,000.

● It has been reported that Mexico is seeking to buy 80 more diesel locomotives in this country at a cost of $11,570,000.

● The Louisville & Nashville RR has announced that it intends to spend $17,000,000 for new diesel engines, box cars and heavier rails.

● The Missouri Pacific has been authorized to purchase diesel locomotives and dome cars at a cost of almost $18,000,000.

● The Long Island Railroad has announced its intention, subject to court approval, of buying twelve diesel locomotives.

● Forty-eight diesel switching locomotives powered by Sulzer engines will soon be delivered to the French National Railways.

● Highway construction contracts totaling $1,011,200,000 on 41,716 miles of highways were let in the first eight months of last year according to the Bureau of Public Roads.

● The Santa Fe has installed a five-chime whistle on Locomotive No. 29. The diesel was equipped with the standard air horn when delivered but the whistle was installed in response to complaints.

● Mercedes-Benz is offering a car powered either by a gasoline or diesel engine. The engines have many interchangeable parts and the additional cost of the diesel is approximately $300.00.

● The Electro-Motive Division of GM now employs 14,821 persons, an increase of 1086 over 1949.

● The B & O is expanding its diesel fleet with the purchase of 90 GM diesel units.

● One hundred per cent dieselized railroads now include the Toledo, Peoria & Western and the Chicago & Western Indiana.

● The Reading Company has announced that it will soon purchase twenty diesel switchers, ten from Baldwin and ten from Alco.

● An order for eight diesel locomotives has been placed with Montreal Locomotive Works by the Canadian National Railways.

● The Southern Railway recently placed orders for 100 diesel locomotives. The diesels will be built by Alco, EMD and Fairbanks.

● The British Railways is currently testing a diesel-electric locomotive which is designed for use in branch line and local train service.

● New orders for 75 diesel buses have been received by Mack Truck. Fifty buses were ordered by the City of Cleveland and 25 by the Portland (Ore.) Traction Company.

● Aluminum Association members report continued high levels of primary aluminum production with an increase in August shipments of sheet and plate of 22,594,751 lb. over those of July.

● Quiz techniques are exploited in an excellent truck booklet by GMC. Pointed questions hit at popular misconceptions concerning diesel powered trucks. Notable among these are that long hauls and heavy loads are a necessity for economical operation.

Diesels in the Lumber Industry

by George W. Grupp

This is the fourth in a series of articles by George W. Grupp about the use of diesels in the various industries of the country. The series started in September with railroads and has covered construction and agriculture. Last month it was necessary to interrupt the sequence of articles because of the special tool and maintenance issue.

DIESEL engines have achieved a wide acceptance in the lumbering industry chiefly because of the low cost of operation inherent in the diesel engine because of its high efficiency and the fact that it burns a fuel which is cheap in comparison to gasoline. Diesels are found in every part of the industry from the initial step of cutting the tree to the final product. They are replacing steam and animal power as well as gasoline power at an ever-increasing rate and it is expected that this trend will continue until the industry has converted almost 100 per cent to diesel power.

Diesels are used to power bulldozers, shovels, and road construction and maintenance equipment used on the lumber highways through the timberlands. Crawler tractors used in logging operations are diesel powered as well as the cranes and loaders used with diesel truck and trailer combines which haul the timber from the forest and mills to the manufacturing plants.

Electric current for lumber camp facilities is provided by diesel-generator sets. These sets also provide power for lumber camp repair shops and sawmills and to operate field equipment. At a few large lumber shipping points small diesel locomotives haul loaded freight cars through canyons of lumber piles. Diesels also power the work boats, especially on the rivers of the Pacific Coast, which make up timber into huge rafts to be floated or pulled down the rivers, again by diesel powered craft.

There are several reasons behind this trend toward diesel power in the lumber industry. To understand the reasons for this trend, it is necessary to have some background information on the industry and its development.

When the first settlers came to this country, they were confronted with huge stands of virgin timber waiting to be cut and used. As the country was developed and settled, almost every new area was found to possess huge quantities of timber with the result that this country became one of the greatest users of wood and wood products in history.

Because of the tremendous quantity of available timber, it was not thought necessary to practice conservation and it was again unnecessary to range very far afield from population centers to find large stands of timber waiting to be cut. However, in this century, and particularly in the past twenty years, the lumber industry has been converted to conservation practices because of the decrease in available timber stands. The industry has also been forced to go farther away from population centers to find stands suitable for logging operations.

Bucyrus Erie diesel-powered shovel at work on a lumber road in the lumber country.

Part of the truck fleet of the Red River Lumber Co. of California. The trailers are normally mounted on the trucks as shown for the return trip after the load has been delivered.

As the operations of the industry moved away from power sources, a demand grew for small, easily portable equipment which could be moved easily and quickly to new timber stands. Steam power has been used for a long time but, with the advent of the diesel, the industry was quick to recognize the advantages of the new form of power and take advantage of the opportunity for more efficient operation.

Logging companies have learned that the cost of delivered fuel oil for diesel donkey engines, even when brought in by aircraft, is much lower than the cost of wages for steam donkey attendants such as fuel wood cutters and firemen. In some instances it has been found that the operating costs of dieesl donkey engines are only one-third that of steam donkey engines.

When the loggers recognized that our timber resources were being depleted, a number of things took place in the lumber industry. First, diesel engines increased in sawmills where considerable power was needed. Second, small sawmills, which are usually located closer to the timber stands, began to increase their proportion of the over-all production of lumber.

Diesel tractor-trailer rig hauling a load of timber to the mill. This rig is similiar to those shown on the preceding page. Its normal load is 10,000 board feet.

Cat diesel tractor with Hyster Arch and Winch pulling logs from Arizona timber land. All photographs courtesy of the American Forest Products Industries and the U. S. Forest Service.

In this transition it was natural for the small sawmills, (those which produce less than 10,000 board feet per day), to find that steam engines were not as economical, or as mobile, as diesel engines. As a result, in the 200 to 1,200 sawmills in each of the 40 forested states, one can find many portable, and mobile small diesel powered sawmills.

These portable sawmills, mounted on wheels, or sleds, or in temporary structures, now penetrate into what was once considered inaccessible timber stands — stands which can now be converted into profitable lumbering ventures. These portable sawmills are also used to convert the remaining material of cut-over areas into rough lumber for wood product plants.

Third, to lower production costs, for competitive purposes, improved mechanization for felling, bucking and transporting operations was introduced to offset both wage increases and decreased labor efficiency. Obviously, this stimulated the demand for diesel powered equipment.

Diesel engines have many advantages. Their comparative lightness in weight enhances their mobility. They are easy to operate and have sufficient power for the needs of sawmills and other lumbering operations. They reduce the fire hazard in lumbering. And their costs of operating are less than steam engines.

Looking at this from another viewpoint, the most important developments in lumber technology since 1920 have been (a) the substitution of steam cable yarding donkey engines with gasoline and diesel engines because internal combustion engines eliminate the cost of labor required to cut and gather wood, and (b) the adoption of tractors, trucks and trailers, and light cable yarders because of their greater economy and because of their flexibility.

These comparatively recent types of equipment used by the lumber industry have made it possible to log scattered timber stands, and to engage in selective logging — selecting trees which interfere with the growth of others and in the selecting of only those trees which are ripe, or deformed. Such operations could not be profitably performed with heavy steam cable yarders and with lumber camp railroads.

Today diesel cable yarders snake 35 to 80 foot logs over mountains and across rough ground both easily and swiftly. Diesel engines, because of their compactness, high speed, low weight, and easy portability, have made logging operations possible on steep mountainsides and in what were once considered inaccessible valleys. In other words, because diesel engines increased the mobility of yarders and loaders it is now possible to cut timber which would never have been logged.

The diesel tractors' ability to develop more power because of their efficiency soon made them very popular with loggers. For example, it has been learned that a 43 bhp. diesel tractor can skid 1000 board feet of logs per hour with a fuel consumption of only 14 gallons for each 8 hours of service.

In a test between a 75 hp. diesel tractor and a 60 hp. gasoline tractor it was found that the diesel tractor could haul 61 per cent more board feet of lumber per hour than the gasoline tractor. The diesel tractor's fuel cost per thousand board feet logged was 30 per cent less than that of the gasoline tractor. The diesel tractor could negotiate 40 per cent grades as compared with the 30 per cent grades of the gasoline tractor.

Diesel crawler tractors are preferred to wheeled tractors because they have

Average Fixed Costs Per Minute Throughout Year on 10 Hour Day and 5 Day Week Basis of Log Hauling Truck and Trailer Combinations of 15 Northwestern Lumber Companies

Gross Weight of Vehicle in Pounds	Depreciation		Interest		Insurance		Total	
	Gas-oline	Diesel	Gas-oline	Diesel	Gas-oline	Diesel	Gas-oline	Diesel
50,000 to 60,000	$0.0059	.....	$0.0031	.....	$0.0030	.....	$0.0120	.....
60,000 to 80,000	0.0073	$0.0081	0.0038	$0.0041	0.0036	$0.0036	0.0147	$0.0158
80,000 to 96,000	0.0093	0.0099	0.0049	0.0051	0.0041	0.0041	0.0183	0.0191
96,000 to 114,000	0.0118	0.0125	0.0062	0.0065	0.0046	0.0046	0.0226	0.0236
114,000 to 164,000	0.0133	0.0140	0.0074	0.0077	0.0050	0.0050	0.0257	0.0267
164,000 to 207,000	0.0158	0.0165	0.0096	0.0099	0.0060	0.0060	0.0314	0.0324

SOURCE: U. S. Forest Service; Study made in 1947.

Note that the total fixed costs are greater for the diesel than for the gasoline equipment. This is because of the higher first cost of the diesel. However, note the savings effected with diesels as shown in the table in the lower left corner of the next page.

greater pulling power. With winches these tractors can develop 50 to 80 per cent more power than at their draw-bars.

An 80 hp. diesel tractor with a towing winch can haul 10,300 to 11,100 board feet of lumber a distance of 1000 feet per hour, or 3940 to 4300 board feet of lumber a distance of 4000 feet per hour.

Results as just pointed out, and many others, have not only developed into a trend to replace small gasoline tractors with large diesel tractors, but they have also made the diesel tractors universally acceptable to the loggers.

In making an analysis of only 9300 diesel crawler tractors used in logging operations, the United States Forest Service estimated that 32 per cent were under 35 hp.; 27 were between 35 and 49 hp.; 14 per cent were between 50 and 64 hp.; 11 per cent were between 65 and 86 hp.; and that 16 per cent were 87 hp. and over.

These and many other diesel tractors are used for the transporting of logs and pulpwood (1) by ground skidding; (2) by pan dry skidding; (3) by fairlead arches; (4) by wagons and trailers; (5) by winches; (6) by trailing logs in chutes; and (7) by hauling logs on sleds.

Diesel tractors are also used by the lumber industry (a) for road construction and maintenance; (b) for building fire guards; (c) for reforestation work; (d) for loading sleds and trucks; (e) for powering portable sawmills; (f) for plowing snow, breakout strips, and branch roads; (g) for carrying supplies; and (h) for powering felling and bucking saws. In the latter usage small generators are mounted on the tractors.

All of these uses of diesel tractors are only possible because they have more speed and power than animals, can operate and log on steep slopes and rugged topography, handle and skid large logs, travel long distances, even along swampy roads.

Other reasons are their ability to increase the rate of lumber production per hour, be worked longer hours than animals and not become fatigued, make possible the logging of remote timber, and leave the forests in a better condition for reforestation.

They also do less damage to young trees, reduce the amount of timber damage in skidding, reduce lumber costs, reduce the need for constructing cable-line skidding equipment, haul timber over wet ground with fairlead arches, and are the solution to high wages and decreased labor efficiency.

The companions of diesel tractors, in modern lumber technology, are diesel trucks. These trucks, which to some extent have steadily replaced water and rail transportation in logging operations, are highly efficient vehicles. They carry heavier loads, and negotiate steeper grades at a faster rate of speed than would be possible with gasoline trucks.

In the Northwest it is not unusual to see a diesel truck and trailer combination haul 80 to 100 tons of logs a distance of 40 miles on roads which have some grades up to 12 and 15 per cent. Lighter loads of logs are sometimes hauled 70 to 100 miles. In rough topography they haul logs from 3 to 15 miles.

Some of the heavy duty diesel log hauling trucks are equipped with dual transmission to give them the power to travel at the rate of 40 mph.

Diesel trucks are especially useful in the lumber industry where the distance is too great for tractors or animals. They are beneficial in logging scattered lots of timber, and in selective logging. They are useful in short hauls on mountainous rough roads. They are profitable to operate where road construction costs are low. And they are especially useful where improved public roads are available.

Huge quantities of logs and lumber are also hauled by diesel powered water craft, especially on the rivers of the Pacific Coast. It is a fascinating sight to see diesel alligator boats boom logs into tremendous rafts of 350 to 1000 cords of pulpwood. Equally fascinating is the sight of rafts of logs from 50 to 125 feet wide and from 100 to 200 feet long with 50,000 to 500,000 board feet being hauled by diesel towboats traveling at the rate of 30 to 40 miles a day.

The maintenance of diesel equipment used by the lumber industry is not much different from that of other industries. Diesel trucks usually work only 9 months of the year. During the remaining three months they are thoroughly serviced. This is in addi-

Size of Sawmills in the United States in 1947

Size of Sawmills in millions of board feet capacity	Number of Sawmills	Percent of Total Footage
50,000,000 and over	43	11.0
25,000,000 to 50,000,000	122	12.0
15,000,000 to 25,000,000	150	8.0
10,000,000 to 15,000,000	181	6.1
5,000,000 to 10,000,000	608	11.8
1,000,000 to 5,000,000	4,467	25.4
500,000 to 1,000,000	6,429	13.0
50,000 to 500,000	25,340	11.8
1,000 to 50,000	15,769	0.9
Total	53,109	100.0

SOURCE: U. S. Bureau of Censes.

Averaae Dependent Costs Per Minute of Drivina Time Plus Delav Time of Log Hauling Truck and Trailer Combinations of 15 Northwestern Lumber Companies for Both Gasoline and Diesel Vehicles Irrespective of Weight of Vehicle

Driver's wages, including annual leave	$0.0295
Social Security Tax	0.0003
Unemployment Compensation	0.0008
Administration	0.0060
Industrial Insurance	0.0024
Total	$0.0390

SOURCE: U. S. Forest Service; Study made in 1947.

tion to the running maintenance service during the operating months. Normally, running maintenance service is performed on a 40 hour, or 1000 mile, basis. Other lumber industry diesel equipment is usually given the maintenance service, as outlined by the engine builders.

Increased usage of efficient diesel powered equipment is essential to the lumber industry not only because it lowers lumbering costs, and increases lumber production efficiency, but also because it reduces waste in logging operations.

The reduction of lumber waste in logging, or in any other manner, is very important for national security reasons, and especially during these troublesome times.

World War II demonstrated the importance of lumber for military operations. Practically every phase of modern warfare depends to a certain degree upon wood.

For example, every armed force cantonment constructed during the last war required about 1500 board feet of lumber per man. Every freighter which sailed from our ports with war supplies required 10 carloads of dunnage to package and to stabilize her cargo. About 300 board feet of lumber were required to package the initial supplies of every man sent overseas; and about 50 board feet of lumber a month were needed to keep him in supplies. A cord of wood was required for smokeless powder used in every 90,000 rounds of rifle ammunition; and a similar amount of wood was required to make the paper used in every 4200 weather-proof packages used to ship blood plasma.

It is because of these and other needs of wood in modern warfare, and the increased demand of wood for civilian needs, that every possible type of equipment, such as diesel crawler tractors which aid in reducing timber waste, should be used to the full.

No arguments against improvements in lumber industry methods can stand up under the fact that about one-third of sawed timber is presently wasted. For example according to the United States Forest Service, in the logging and manufacturing of all timber products in 1944, timber converted into lumber, pulpwood, etc., amounted to 43.0 per cent; 22.5 per cent was used for fuel; and 34.5 per cent was wasted.

Because of those conditions, today such organizations as the American Forestry Association, the American Forest Products Industries, the National Lumber Manufacturers Association, and the federal and state forest services are all working together with greater enthusiasm than ever before in their joint efforts to reduce lumber waste, and for the encouragement of better lumbering methods, such as block tree harvesting, and selective logging.

Average Operating Costs Per Minute of Driving Time of Log Hauling Truck and Trailer Combinations of 15 Northwestern Lumber Companies

Gross Weight of Vehicle in Pounds	Fuel		Lubrication		Repairs		Total	
	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel
50,000 to 60,000	$0.0154	.....	$0.0015	.....	$0.0300	.....	$0.0466	.....
60,000 to 80,000	0.0178	$0.0078	0.0018	$0.0034	0.0377	$0.0431	0.0573	$0.0543
80,000 to 96,000	0.0239	0.0106	0.0024	0.0047	0.0495	0.0565	0.0758	0.0718
96,000 to 114,000	0.0317	0.0139	0.0032	0.0061	0.0628	0.0718	0.0977	0.0918
114,000 to 164,000	0.0358	0.0157	0.0036	0.0069	0.0700	0.0800	0.1094	0.1026
164,000 to 207,000	0.0358	0.0157	0.0036	0.0069	0.0837	0.0957	0.1231	0.1183

SOURCE: U. S. Forest Service; Study made in 1947.

Average Fuel Consumption of Gasoline and Diesel Trucks Operating in Northwestern Lumber Camps

Gross Weight of Vehicle in pounds	60,000 to 80,000	80,000 to 96,000	96,000 to 114,000	114,000 to 207,000
Horsepower	125 to 150	150 to 200	200 to 265	265 to 300
Gallons of gasoline consumed per round trip minute of driving time	0.121	0.162	0.215	0.243
Gallons of Diesel fuel consumed per round trip minute of driving time	0.071	0.091	0.126	0.143

SOURCE: U. S. Forest Service; Study made in 1947.

A Comparative Hourly Cost of Logging With Tractors

Cost Item	35 hp Diesel Tractor with winch equipment	% of Total Hourly Cost	35 hp Gasoline Tractor with winch equipment	% of Total Hourly Cost
Direct Labor Cost				
Driver	$0.400	20.6	$0.400	15.1
Helper	.275	14.2	.275	10.3
Employee insurance	.022	1.1	.022	0.8
Total direct Labor Cost	$ .697	35.9	$ .697	26.2
Supervision	$ .133	6.8	$ .133	5.0
Other Direct Costs				
Fuel	.074	3.8	.644	24.2
Lubricating oil	.025	1.3	.036	1.3
Grease	.035	1.8	.035	1.3
Starting engine Gasoline	.004	0.2	....	....
Service labor	.048	2.5	.082	3.1
Cable and rigging	.190	9.8	.343	12.9
Repair parts and labor	.296	15.2	.296	11.1
Transportation of crew	.063	3.2	.063	2.4
Total other direct costs	$ .735	37.8	$1.499	56.3
Ownership Cost				
Depreciation (12,000 hrs.)	$ .278	14.3	$ .244	9.2
Interest at 6%	.060	3.1	.053	2.0
Taxes (1.5%)	.015	0.8	.013	0.5
Fire Insurance (0.75%)	.008	0.4	.007	0.2
Uninsured risk (1.75%)	.017	0.9	.015	0.6
Storage	....	....	....	....
Other costs	....	....	....	....
Total Ownership cost	$ .378	19.5	$ .332	12.5
Total Hourly Cost	$1.943	100.0	$2.661	100.0
Man-hour Cost (2 man crew)	$ .972		$1.330	

SOURCE: Cost of Tractor Logging in the South; U. S. Agricultural Technical Bulletin No. 700, Nov., 1939.
NOTE: While study is old and individual costs out of date, the pattern is valid.

Plant Capacity Raised by Supercharging

Supercharging of existing atmospheric engines is a fast, economical and efficient means of meeting currently increasing power demands. It affords time for projecting future demands, as well as for planning, procurement and installation of new engines as needed. Some results of such a conversion are given.

by T. J. Malone

SUPERCHARGING two atmospheric engines in the five-diesel municipal power plant in Columbus, Wisconsin, solved a troublesome power problem. The additional capacity obtained relieved the minds of the responsible authorities with an assurance that they could meet the requirements of this community of 3230 people.

Municipal power generation started at Columbus in 1899 when a dc. steam plant was installed. Operation continued until 1921 at which time power was purchased from a private utility and distributed on the municipality's own system. The diesel plant was completed early in 1941 and operated for 10 months that year.

Three Worthington non-supercharged engines were installed at the outset. The fourth engine, a 4-cycle, supercharged Nordberg unit, began operation on January 1, 1947. This engine is rated 1200 hp. and drives an 840-kw. Electric Machinery alternator. Two years later, the fifth engine went into operation. It was a 16-cyl., 2-cycle General Motors unit rated 1500 hp. and driving a 1000-kw. Ideal alternator. This equipment was government war surplus.

Three objectives were sought by the conversion: Increased power capacity; greater fuel economy; and an extension of the useful life expectancy on a high efficiency basis.

Conversion for supercharging transformed these 8-yr. old diesels into modern units, equal to new, giving assurance of many additional years of low cost power production. Had new engines been bought and these engines not converted, their utility from an economic viewpoint would have suffered, relegating them to peak load or other intermittent service.

Alteration of the engines necessarily included changing of the alternators. The new Electric Machinery units, rated 1000 kw., were designed for a speed of 3600 rpm. which permitted a corresponding engine speed. This increase brought the engine speed up to its original design rpm. and this, plus the higher bmep. due to turbocharging, upped the hp. rating to 1440.

The total gain amounted to 66 per cent increase in potential without moving an engine or enlarging the powerhouse and without the considerable loss of time incident to new engine purchase and installation. The cost of the work ran about $45,000.00 per engine.

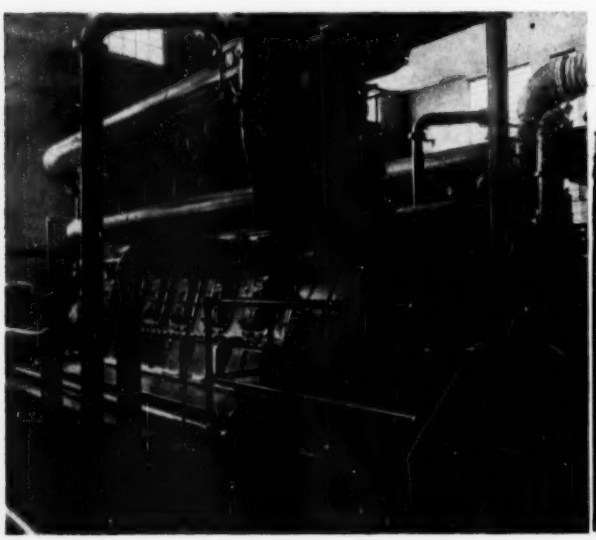
The turbochargers were mounted at the alternator end in the conventional location. New equipment included pistons and cylinder liners and an enlarged oil cooler.

Conversion kept the engines out of operation, one for 70 days and the other, 96 days. Yet in the balance of 1949 they ran 204 and 108 days, respectively. Together, they supplied most of the yearly output of the plant.

In the first seven months of 1950 the fuel economy of the three Worthington engines, Nos. 1 & 2 being supercharged, was as follows:

	Kw. Hr. per Gal.		
	No. 1W	*No. 2W*	*No. 3W*
Jan.	14.2	13.7	13.0
Feb.	14.2	13.9	12.9
Mar.	13.9	13.5	13.0
Apr.	13.8	13.7	13.0
May	13.6	13.4	12.7
June	13.5	13.2	12.7
July	13.6	13.2	12.6

Plant Superintendent, F. H. Roob, apparently likes his turbocharged Worthingtons and runs them as much as possible using the other two engines as peak-skimmers or for stand-



(left) One of the two supercharged Worthington engines showing turbocharger mounted at the alternator end. (below) Lube oil filter and compressed air tanks for starting air. Part of the compressor can be seen behind the post.

by use. The two turbocharged Worthingtons are run at a load factor of around 80, never below 75 and attempt is made to keep them below 90.

An indication of load distribution is given in the operating hour figures for 1949 given below:

		Hours Operated
No. 1	*(Super. Worthington)*	4619
No. 2	*(" ")*	4160
No. 3	*(Atmos. ")*	1288
No. 4	*(Super. Nordberg)*	491
No. 5	*(General-Motors)*	252

The plant load factor for this period was 48.4 per cent and the overall fuel economy 12.7 kw.hr. per gal. It should be noted that this figure represents economy before and after conversion as well as the time that the two engines were out of service. The figure for the first seven months of 1950 is more representative of the economy after the conversion and is shown in the accompanying table as 13.35 kw.hr. per gal.

During the period 1945 to 1949, the power demand increased at a rate of better than 1,000,000 kw.hr. per year. Comparison of yearly peak loads with the rated capacity shows the years when capacity was strained. Overloading was common in 1946.

Decrease in generating costs in 1949 is largely attributable to the economy gained by supercharging and partly as the result of lower fuel oil cost, an average of 10.16 cents per gal. in 1949 compared with 12.5 cents in 1948. In addition, there was less lubricating oil consumed as the turbocharged Worthingtons showed an increase in hp. hrs. per gal. of lube oil.

Consumers served by this plant are now assured of adequate capacity, economical operation permitting favorable rates, and security for the future. The largest consumer in 1949, as in previous years, was an REA cooperative. This organization paid the city an average of 1.62 cents per kw. hr. in 1949.

The municipal plant operates the cooperative but does not own it. It is governed by a Board of Directors with the plant superintendent as REA manager. The two daily peak loads of both the plant and the cooperative do not coincide and the plant superintendent, serving in this dual capacity, is in a position to adjust plant operation to meet demands in the most efficient manner.

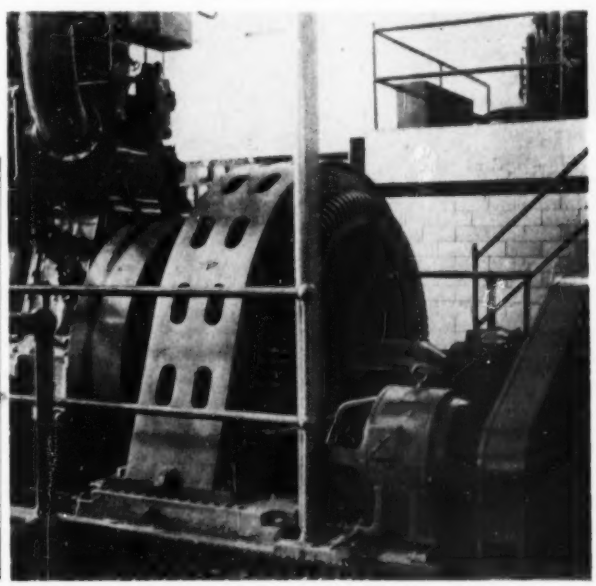
The plant supplies 1661 meters, 400 stoves and 352 water heaters. Residential use accounted in 1949 for 1,882,807 kw.hr.; commercial lighting = 1,220,503; commercial power = 1,173,664; and water heating = 1,005,688. Residential rates start with a fixed charge of 50 cents per month: 3 cents per kw.hr. for the first 100 kw.hr., net, and 2.1 cents for any excess. There are just the two steps and these charges represent about a 15 per cent increase over rates prior to April 1, 1949.

Commercial lighting is billed at a fixed charge of 60 cents per month, 3 cents net for 300 kw.hr. and 2.1 for any excess. Commercial power bears a fixed charge of 30 cents net per hp. of connected load, and then follows the pattern for lighting.

Since its inception the diesel plant has been able to more than pay its way while providing low cost power. When the diesels took over, the plant had a book value of $85,970 and showed an earned surplus of $198,034. Under the Wisconsin law municipal electric earnings may not be diverted to other city purposes; all must be used for the plant itself. As of July 31, 1950, accumulated earned surplus stood at $575,891; there was $133,077 cash in the bank and money invested. The plant borrowed $175,000 in 1948, by issue of revenue bonds, to pay for the supercharging of the two engines and for other improvements.

A Water and Light Commission of five members, appointed by the City Council, governs the affairs of the plant. Members in 1950 included H. L. Zeidler (also mayor), A. H. Proctor, John G. Heidke, Clark Arnold, and George Roberts. The Mayor and Mr. Heidke have served together for more than 20 years and Mr. Roob, plant superintendent who doubles as Commission secretary, has worked with the plant for 38 years.

Members of the Commission are justifiably proud of the present plant and its record. They invite inspection.



(right) The new Electric Machinery generator which is connected to one of the Worthingtons and, below, table of operating data for the plant. Note footnotes which explain some of the data.

Calendar Yr.	Kw. Hr. Generated	Kw. Hr. Per Gal. Fuel	Av. Costs Per Kw. Hr. (generated)	Av. Costs Per Kw. Hr. (delivered)	Revenue (Av.) Per Kw.Hr. (generated)	Peak Load Kw.Hr.	Rated Kw.Hr. Cap'y	Line Loss, Gen. %
1942	4,251,100	12.8	-----	1.250	2.00	1160	1800	5
1943	4,796,400	12.6	.657	1.175	1.67	1200	1800	4.65
1944	5,677,000	12.8	.760	1.155	1.67	1540	1800	4.46
1945	6,496,150	12.4	.91	1.155	1.64	1790	1800	6.65
1946	7,592,900	13.0	.925	1.145	1.65	2000	1800	6.0
1947	9,006,900	13.2	1.10	1.25	1.70	2925	2640	4.0
1948	10,601,300	13.0	1.25	1.70	1.75	2600	2640	5.6
1949	12,175,200	12.7	1.01	1.48	1.80	2850	4440†	6.0
1950††	7,729,300	13.35	-----	----	----	2700	4440	----

Notes: Costs in cents

* Does not include distribution, general and administrative costs, depreciation, interest and taxes

** Includes items above † After conversion ††Seven Months' Operation

Btu's Per Kilowatt Hour

An improved basis for measuring fuel consumption efficiency

FOR A GOOD many years, it has been standard practice to express the fuel consumption efficiency of stationary power plants in electrical generating service on the basis of the kilowatt hours produced per gallon of fuel. The Oil Engine Power Cost Committee, Oil and Gas Power Division of the ASME, now suggests that Btu's per kilowatt hour is an improved basis for such computations.

Reasons for this recommendation become apparent when the function of this Committee is considered. One clue is contained in the recent change in its name to the Oil and Gas Engine Power Cost Committee.

Rapid developments and expansion in the use of gas diesels, dual-fuel engines and gas engines, all falling within the scope of the parent Division, have emphasized the difficulty in reporting operating costs for incorporation in the Division's yearly publication. "Oil Engine Power Cost." The name of this publication is also to be changed.

Reports from plants having gas burning engines, whatever the type, create a problem since gas consumption is reported in Btu's per kw. hr. There is no direct means of correlating this with the report of kw. hr. per gal. for the fuel oil consumed by mixed plants in diesel engines, as pilot oil, etc., so that a total consumption can be given for purposes of comparison with other plants.

The Committee is extremely practical and realizes that a change in a long established practice cannot be accomplished overnight. While stressing the advantages to the plant operators of using the suggested method of expressing fuel efficiency, they emphasize only a single item of information to facilitate their important work: the average A.P.I. gravity of the fuel oil used during the reporting period.

If the A.P.I. gravity of a fuel is known, along with the total amount consumed, it is compartively simple to convert these factors to obtain the heating value of the total in Btu's. The accompanying table shows the correlation.

Relative specific gravities are also shown so that in the event that the A.P.I. gravity is not known, it can easily be determined by an ordinary hydrometer. Many are calibrated to read directly in A.P.I. gravity. However, most oil suppliers can give the A.P.I. gravity of a particular batch and the figure for each sizable delivery should be noted so as to enable an average based on proportions to be reached for purposes of reporting.

Once the Committee obtains a plant's gas consumption in Btu's per kw. hr. and oil consumption in kw. hrs. per gal. *plus* the average A.P.I. gravity, it will be in a position to compute total efficiencies on a Btu. basis.

There is still the problem that fuel oil is rated on the high or total heat basis and gas on the low or net heat values. Since this difference in method of rating is one of long standing and

Table correlating A. P. I. gravity of fuel with heating value in total Btu's. Values for 10 to 49 deg. API inclusive from Bureau of Standards; values 5 to 9 inclusive from Socony-Vacuum Oil Co., Inc.

GRAVITY AT 60/60 F		DENSITY, AT 60°F	TOTAL HEAT OF COMBUSTION	
DEG. API	SPECIFIC GRAVITY	LB. PER GAL.	BTU PER LB.	BTU PER GAL. AT 60°F.
5	1.0366	8.643	18,250	157,700
6	1.0291	8.580	18,330	157,300
7	1.0217	8.518	18,390	156,600
8	1.0143	8.457	18,440	155,900
9	1.0071	8.397	18,490	155,300
10	1.0000	8.337	18,540	154,600
11	0.9930	8.279	18,590	153,900
12	0.9861	8.221	18,640	153,300
13	0.9792	8.164	18,690	152,600
14	0.9725	8.108	18,740	152,000
15	0.9659	8.053	18,790	151,300
16	0.9593	7.998	18,840	150,700
17	0.9529	7.944	18,890	150,000
18	0.9465	7.891	18,930	149,400
19	0.9402	7.839	18,980	148,800
20	0.9340	7.787	19,020	148,100
21	0.9279	7.736	19,060	147,500
22	0.9218	7.686	19,110	146,800
23	0.9159	7.636	19,150	146,200
24	0.9100	7.587	19,190	145,600
25	0.9042	7.538	19,230	145,000
26	0.8984	7.490	19,270	144,300
27	0.8927	7.443	19,310	143,700
28	0.8871	7.396	19,350	143,100
29	0.8816	7.350	19,380	142,500
30	0.8762	7.305	19,420	141,800
31	0.8708	7.260	19,450	141,200
32	0.8654	7.215	19,490	140,600
33	0.8602	7.171	19,520	140,000
34	0.8550	7.128	19,560	139,400
35	0.8498	7.085	19,590	138,800
36	0.8448	7.043	19,620	138,200
37	0.8398	7.001	19,650	137,600
38	0.8348	6.960	19,680	137,000
39	0.8299	6.920	19,720	136,400
40	0.8251	6.879	19,750	135,800
41	0.8203	6.839	19,780	135,200
42	0.8155	6.799	19,810	134,700
43	0.8109	6.760	19,830	134,100
44	0.8063	6.722	19,860	133,500
45	0.8017	6.684	19,890	132,900
46	0.7972	6.646	19,920	132,400
47	0.7927	6.609	19,940	131,900
48	0.7883	6.572	19,970	131,200
49	0.7839	6.536	20,000	130,700

is involved in various power test codes, etc., no effort will be made to alter this. The Btu. consumption of each fuel will simply be added to give a total for the plant. Since all computations are to be made the same way and inasmuch as the principal purpose of the figures is one of comparison, any deviations from actual Btu. consumption are relatively minor and of little importance.

So much for the work of the Oil and Gas Power Cost Committee. Their requests are reasonable and, as has been mentioned, compliance offers benefits to the plant operator. The major fault in the kw. hr. per gal. method of indicating fuel efficiency is that there is no correlation with the type of fuel used.

Of two plants reporting the same efficiency, one may be using oil with a higher heating value than the other, thus invalidating direct comparison. Assume that one plant is using a 20 A.P.I. gravity oil and the other, a 38 gravity oil. Both are reporting 12 kw. hr. per gal.

Heating values of the two oils are 148,100 and 137,000 Btu's per gal. respectively. For greater accuracy the heat values should be corrected since the figures given in the table are for oils free from water, ash and sulfur.

$$Q_c = \frac{Q_v[100 - (\%H_2O + \%ash + \%S)] + X(\%S)}{100}$$

Where: Q_c = Corrected total heat of combustion
Q_v = Total Heat (from table)
H_2O = water
S = sulfur
X = 40.5 (for values in Btu/lb.)
= 338.0 (for values in Btu/gal.)

A simple correction formula may be applied as illustrated. Applying the correction to the oils mentioned, assume a total of 3 per cent contamination of which 2 per cent is sulfur for the 20 gravity oil and 1 per cent total contamination of which 0.5 per cent is sulfur for the lighter oil. The corrected heating values are (rounded out to the nearest 100 Btu.) 144,300 and 135,900, again respectively. If the engine using the oil with the lesser heat value is used as a base, the other engine should produce about 12¾ kw. hr. per gal. if the engine thermal efficiencies are equal.

It is realized that the illustration is possibly exaggerated by the use of so wide a range of gravities. In addition, not all engines could use 20 gravity fuel oil for reasons of size, speed, combustion systems, etc. Considerations involved in the use of the heavier fuel may also alter the picture somewhat but the principle remains valid.

Use of this suggested method will undoubtedly aid the operator and give him not only a clearer picture of his operating efficiency, but will also give him a check on the heating value of the fuel he is buying. Further, a lot of confusion will be eliminated in gauging the efficiency of mixed plants.

Diesel engines utilize fuel on a Btu. basis: Why not buy it and figure it on the same principle?

Diesel Trademark Controversy

ATTEMPTED registration in foreign countries of the word "Diesel" as a trademark or portion thereof by the Diamler-Benz Company of Germany and other organizations is a matter of concern to American engine builders. This was evidenced by the attendance of engine company executives and legal representatives at a Diesel Trademark Meeting held in Chicago.

Mr. G. F. Hauke, patent counsel, Continental Motors Corp., served as chairman and explained that the purpose was to discuss ways and means to combat objectionable trademark applications. He explained that Diamler-Benz was apparently attempting to register all over the world a trademark carrying the word "Diesel." Similar action is reported on the part of a Spanish organization and others, with Latin America as the principal target.

Similar attempts have taken place in the past with some successfully opposed and others, as in the case of the Diamler-Benz trademark in Iran, had gone too far with the only possible redress, court action. In addition, different situations exist with respect to the various countries. For example, in Argentina, it is reported as a common practice to permit filing of the owner's corporate name as a trademark and the word "Diesel" might be contained. Opposition may involve lengthy and costly litigation.

The significance of the whole matter was evident when the meeting was advised that successful registration in some South American countries of trademarks containing the word "Diesel" would make it possible to stop at Customs any product marked in any way with the word "Diesel."

Diamler-Benz points out that they simply wish to emphasize that equipment bearing the controversial trademark is diesel powered and that they have no intention through such registration to hinder the sales of diesel engines of other makes. Under German practice, they cannot derive the exclusive right from this registration to exclude other persons or firms from the generic use of the word "Diesel."

While this principle is effective in many countries, it was the consensus of those assembled that in the interests of safety it would not be sufficient to ask for a formal disclaimer of any such exclusive rights where application concerned Latin American countries. It was felt that this action would only afford minimum protection, and therefore complete elimination of the word "Diesel" should be sought.

American engine builders have taken individual action to oppose such objectionable trademark registration and this was felt to be the most effective type of opposition. However, a "Watching Committee" was appointed to act as a clearing house for all information pertaining to the subject. Personnel consists of: G. F. Hauke, chairman, Continental Motors Corp.; F. M. Mason, Fairbanks, Morse; E. J. Ashton, Caterpillar Tractor; and Paul Pippel of International Harvester.

Mr. Charles Spice of the Internal Combustion Engine Institute acquainted the British Internal Combustion Engine Manufacturers Association with this situation and enlisted their aid. They are cooperating through action along similar lines to those adopted in this country.

Harlan Municipal Plant Has Impressive Record

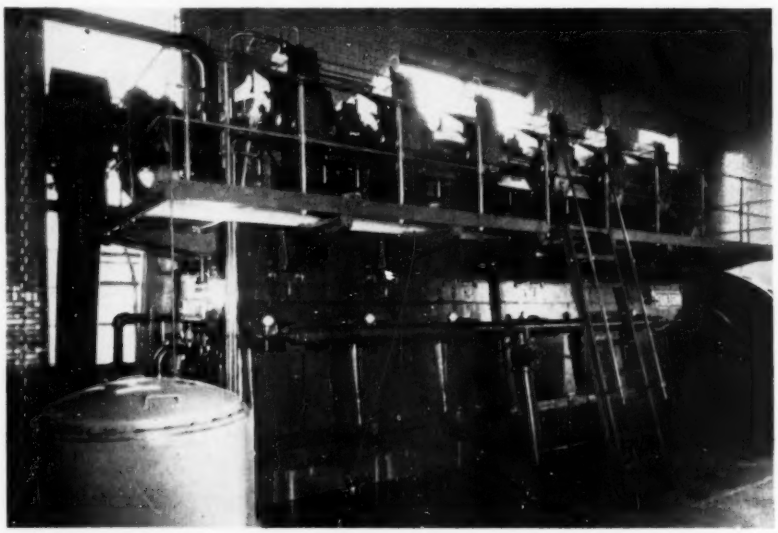
SIX Fulton diesels in the Harlan, Iowa, municipal power plant have generated more than 108,696,000 kw. hrs. in the 21 years since the first units were installed. In more than 220,000 hours of service, the engines have never once caused a plant outage. Today, a new 2760-hp. unit, largest in the plant, is producing 14 kw. hrs. per gal. of fuel consumed to lead Harlan to greater efficiency and greater profits.

This Iowa community of 4200 population has produced its own power since 1891 when a small steam plant was established. The present building was erected in 1929 at which time three air-injection Fulton diesels rated at 375-hp., 500-hp. and 625-hp. were installed. All but the smallest engine are still in service.

In 1936, the building was extended to accommodate a 1000-hp. air-injection engine, and two years later, the first mechanical-injection unit, a 2000-hp. Model KS Fulton, was put to work. This was the lineup that carried the expanding load for eight years including the difficult war period.

The next expansion came in 1946 in the form of another Model KS, a 1500-hp. unit which replaced the old 375-hp. engine. Finally, in August, 1949, the plant's capacity was raised to 8385 hp. with the installation of 2760-hp., mechanical-injection, 4-cycle, supercharged Model KSS Fulton diesel. This 6-cyl. unit, with 24-in. bore and 28-in. stroke, develops its rated horsepower at 240 rpm.

In its first full year of operation, the new engine ran 4811 hours at loads varying from 57.2 to 70.0 per cent capacity. In that time, the engine generated 6,316,000 kw. hrs. while consuming 450,510 gal. of fuel, an average of 14.01 kw. hrs. per gal. of fuel. During the same period, the unit used 2155 gal. of lubricating oil, an average of 6161 hp. hrs. per gal. of lube. Table I gives monthly figures for the year on kw. hrs. generated and lube and fuel consumption both for the new



(above) The 2760-hp. Fulton engine installed in August 1949, and, below, a view of the engine room of the plant showing four of the six Fultons in operation there. The operating record of the plant and the new engine are given in the table on the following page.

engine and for the entire plant. With every prime mover in the plant seeing service — including the 21-year-old air-injection units — the plant attained an average of 13.26 kw. hrs. per gal. of fuel consumed.

Two factors should be considered which make the efficiency of these diesels even more impressive: First, since the air-injection engines are usually under 12 kw. hrs. per gal., there is a tendency to use the newer engines even when load factors are not conducive to peak efficiency.

Second, the fuel now in use is a 36 gravity oil of comparatively low Btu. content which yields approximately 0.5 kw. hr. less per gal. than the fuel previously used. The new fuel,

	Kw. Hr. Generated		Gal. Fuel		Kw.Hr. per Gal.		Gal. Lube		Peak
1949	New Eng.	Total Plant	New Eng.	Total Plant	New Eng.	Plant	New Eng.	Plant	Load Kw
Aug.	138,000	1,063,400	9,865	81,556	13.99	13.03	66	1,592	2,700
Sept.	479,000	998,800	33,735	72,934	14.20	13.69	158	462	2,650
Oct.	500,000	1,069,200	35,331	80,860	14.15	13.22	263	489	2,800
Nov.	318,000	1,043,700	22,720	78,462	14.00	13.30	92	617	3,000
Dec. 1950	731,000	1,242,300	51,510	92,248	14.19	13.46	203	414	3,500
Jan	676,000	1,320,800	47,555	97,677	14.21	13.52	193	432	3,350
Feb.	636,000	1,176,600	45,117	87,379	14.09	13.46	176	514	3,100
Mar.	688,000	1,366,600	48,675	102,173	14.13	13.37	192	526	2,950
Apr.	622,000	1,267,700	44,294	95,379	14.04	13.29	172	443	3,150
May	434,000	1,067,900	31,670	83,187	13.70	12.08	310	589	2,800
June	645,000	998,400	47,049	76,871	13.70	12.98	195	369	2,600
July	449,000	1,019,200	32,986	79,234	13.61	12.86	135	627	2,850
Total	6,316,000	13,634,200	450,510	1,027,960	14.01	13.26	2,155	7,084	

Operating data for Harlan plant, showing comparison between new engine and total plant.

however, comes at a delivered price of 8.5 cents per gal. compared with 10.21 cents, a saving of 1.71 cents which more than compensates for the lesser heating value.

The fuel comes from an Omaha refinery just 50 miles away. It is heated at the refinery and unloaded hot into Harlan's underground storage tanks. The oil retains enough heat even in the worst winter weather so that there has been no difficulty in handling with the float-controlled, motor-driven rotary pumps which transfer fuel from the storage tanks through meters to the day tanks inside the plant. One interesting feature of the plant is the use of a small motor-driven pump to cool the spray nozzles with fuel oil.

There is nothing haphazard about operation at Harlan. Superintendent George J. Woodhouse and chief engineer, Henry Laube, plan carefully to get the greatest economy for the plant's collective owners and at the same time to protect the valuable equipment.

Thus, in the case of engine lubrication, there is a simultaneous effort to economize on oil and yet see that the engines are well lubricated. All the diesels have provision for cleaning crankcase oil in Fuller's earth filters, in continuous service during engine operation. Included in the pressure lube system of the KS engines are shell-and-tube oil coolers and motor-driven auxiliary lube pumps.

The plant has its own oil-testing equipment which includes a small centrifuge and a falling-ball type dilution indicator. The crankcase lube is tested once a week for dilution, dirt, sedimentation, acid and asphalt. On the basis of these tests, it is determined when filter cartridges need to be changed. The tests also provide clues to other developing problems and generally serve to protect the diesels and reduce maintenance costs.

Cylinders are supplied with fresh lube oil by force-feed mechanical lubricators.

Cooling water, too, is checked carefully and in this case tests are made daily to insure that water in the system be kept to a hardness of just ½ grain and a pH between 9 and 10. A pair of 1500-gpm. motor-driven centrifugal pumps circulate water through the engine jackets, the oil coolers and a new dual spray pond. Make-up water is treated in a zeolite softener and copper sulphate is added daily.

Intake air filters and exhaust silencers are housed in brick chambers outside the building. This serves to warm the engine air during Iowa's cold winters. Conveniently mounted on the engines are pressure gauges and multi-point exhaust pyrometers. There are alarms on low water and oil pressure.

A new 26-panel switchboard was installed in 1948, complete with electrically-operated circuit breakers and recording voltmeter, kw. meter and watt-hour demand meter as well as all the usual equipment. The 120-volt battery which activates the circuit breakers also provides emergency lighting for the plant.

The growth of this plant and its load is an excellent example of planned and controlled development. It was recognized that a larger load than Harlan itself provided would reduce the unit cost of power production and result in greater economies and profits for the citizens of Harlan. Consequently, the plant contracted to serve the nearby communities of Shelby and Tennant at realistic rates which took all costs into consideration and allowed for a reasonable profit. Also the plant expanded to handle a considerable REA load which, at its peak in 1948, reached 1100 kw.

But it was not Harlan's intention to run a power system for the entire region with the danger that the city

(*Concluded on Page* 105)

Principal Equipment Serving New Fulton Engine

Generator	2000 kw., 3-phase, 60 cycle, 2400 v. General Electric Co.
Batteries	Electric Storage Battery Co.
Switchboard	Westinghouse Electric & Mfg. Co.
Fuel System:	
Oil	Searle Petroleum Co.
Filter	W. W. Nugent & Co., Inc.
Meter	Pittsburgh Equitable Meter Co.
Transfer Pump	Worthington Pump & Machinery Corp.
Lube Oil System:	
Oil	Socony Vacuum. DTE #4D in cylinders; Vacme #3 in crankcase
Filters	Honan-Crane
Auxiliary Pump	Tuthill Pump Co.
Mechanical Lubricators	Manzel
Cooler	Ross Heater & Mfg. Co.
Testing Set	Gerin Corp.
Air Filters	Reed Air Filters Co.
Exhaust Silencers	Fulton Iron Works Co.
Exhaust Pyrometers	Brown Instrument Co.
Cooling Water Pumps	Peerless
Goovernor	Woodward Governor Co.

Diesel Engine Bearing Development

*by E. Crankshaw and R. Arnold**

THE MODERN diesel engine, as we know it today, represents the collective efforts and abilities of many people. While it is true that the diesel engine field has enjoyed rapid growth and advancement, these have brought about many problems. Some of these problems have been met and overcome. Others remain, yet to be surmounted.

The engine user is constantly seeking more horsepower, frequently at less weight per horsepower. To the designer, this may mean increased speeds, or higher mean effective pressures, or both. Yet both groups of people must keep in mind the considerations of initial cost and subsequent maintenance charges.

One of the groups who have worked with the engine designers and builders to make their product what it is today is the bearing manufacturers. These people have had to meet most of the problems associated with the engine itself. This is because such modifications as more horsepower, higher speeds, and lighter weight, already referred to above, make themselves apparent in the behavior of the bearings. Nor should it be assumed that the engine designer alone plays a part in bearing life, for the operator and maintenance man is also involved.

It might be well to point out here that this discussion pertains primarily to steel-backed sleeve bearings used as main and connecting rod bearings in diesel engines. These engines also require a variety of sizes and types of other bearings, usually referred to as "bushings," for camshafts, piston pins, rocker arm shafts, accessory drives, etc. These, too, must be carefully engineered for the job they are to do.

Probably the primary requisite of a material to be used as a bearing is its ability to develop but little friction when moved relative to its mating part. From a historical point of view, it is interesting to note that tin base babbitt, while one of the earliest of the bearing metals, is still with us today in a wide variety of applications, but because of certain inherent properties, does not enjoy great use in the diesel field. However, the science of metallurgy has given us other materials, and a few of the many that are available today are presented in Fig. 1 along with their nominal specifications.

We spoke a moment ago of the fact that bearing materials must demonstrate freedom from excessive friction, or in other words, should possess satisfactory surface behavior. This is really a collective term, for it may include wearing ability, embeddability, and hardness. Other criteria by which a bearing material may be judged are fatigue resistance and corrosion resistance.

It is obvious from Fig. 1 that the materials listed there vary widely in their chemical makeup, and it is not surprising to find that this should lead to differences as regards the various criteria enumerated above. If we were to list these bearing materials in their relative order, under the headings of surface behavior, fatigue resistance, and corrosion resistance, we would have the table shown in Fig. 2.

By an inspection of this table, it may be seen that no one material enjoys top rating in all instances. Thus, while lead base babbitt seems to have excellent surface behavior, it is rather poor as regards fatigue resistance. On the other hand, silver demonstrates very good fatigue resistance, but has poor surface behavior. Again, the copper lead alloys are good as regards fatigue life, but poor when rated as to surface action and resistance to corrosion.

While this table rates the given alloys in their relative order only, it is possible, by means of controlled laboratory tests, to rate them on a percentage basis also. An example of this more detailed comparison appears in Fig. 3, where the materials have been rated by a bar graph to show their load-carrying capacities.

This data represents the results of a number of tests run in a bearing test machine under conditions with excellent alignment, adequate lubrication, high cleanliness, ideal clearances and normal operating temperatures. Obviously, such results are usually impossible to obtain in the field because of the difficulty of controlling operating conditions.

In connection with fatigue life, it is now well established that the thickness

Nominal Analysis of Representative Bearing Alloys

Alloy Name	SAE Spec. No.	Composition in Percentage, Nominal				
		Copper	Tin	Lead	Zinc	Others
Silver	17 P	-	-	-	-	99.9 silver
Cadmium-Nickel	18	-	-	-	-	98.7 cadmium, 1.3 nickel
Copper-lead	49 *	75	.25	24.5	-	-
Copper-lead	480	65	-	35	-	-
Aluminum	-	1	6	-	-	91 aluminum, 1 nickel
Tin base babbitt	110	3.3	89	-	-	7.7 antimony
Lead base babbitt	15	-	1	83	-	15 antimony, 1 arsenic

* Used in combination with a thin overlay of high lead alloy.

**Respectively, Assistant Chief Engineer and Supervisor of Dynamometer Laboratory, The Cleveland Graphite Bronze Co.*

of the bearing surface plays an important part. This is the reason for specifying the surface thicknesses in Figures 2 and 3. The interrelations of fatigue life with surface layer thickness may best be demonstrated by means of the graph shown here as Fig. 4.

This likewise represents the results of a number of individual tests, run on bearing test machines under closely controlled conditions. Note that bearing life starts to increase when the surface layer thickness is less than 0.015 in. With a layer thickness of 0.002 in., life expectancy is three times that with the thickness of 0.008 in. While it thus is desirable from a fatigue standpoint to have very thin bearing surface layers, consideration must also be given to the manufacturing costs of producing such bearings.

Having thus obtained a background of what may be expected of some of the common metals and alloys as bearing materials, we turn to the use of these materials in diesel engines. Referring again to Fig. 1, experience has indicated that the loads encountered in diesel service lead to early fatigue of the ordinary babbitt bearings and of the cadmium nickel, and it will be recalled that these are rated "poor" in Fig. 3. Silver, in combination with a thin coating of a material possessing good surface behavior, is widely used in the aircraft industry, but its relatively high cost precludes it from general use. Solid aluminum alloy has been used for several years, and while it has given a good account of itself, has not enjoyed wide application.

The material used most widely in the diesel and heavy duty gasoline engine fields has been the copper-lead alloys. For a number of years the SAE 480 alloy was satisfactory and, while still used to some extent today, it is being replaced by the SAE 49 alloy, in combination with a thin overlay to improve its surface behavior and corrosion characteristics. The combination of two materials, combined so as to realize the advantages of both without their inherent shortcomings, seems at first simple, but was made commercially feasible only after many months of development work, not only in the laboratory, but on the production floor also.

This type of bearing is known as the trimetal type, for it consists of a steel backing onto which is cast the SAE 49 copper-lead alloy. This is then machined completely and the last step in the manufacturing process is the precision plating, on the copper-lead surface, of a lead-tin-copper alloy. No further machining is necessary, for the plated surface is held to a thin, uniform layer, usually of 0.001 in. nominal thickness.

Thus we have a bearing which would rate very well in all of the headings of Fig. 2, for we have utilized the excellent surface behavior and corrosion resistant properties of babbitt, and combined it with the highly fatigue-resistant copper lead.

Characteristics of Various Bearing Materials

Nominal Thickness of Bearing Surface Layer .020"

Surface Behavior	Fatigue Resistance	Corrosion Resistance
(Lead base babbitt	(**Copper Lead, SAE 49	(Silver
(	(	(
(Tin base babbitt	(**Silver	(Tin base babbitt
		(
Cadmium Nickel	Aluminum alloy	(Aluminum alloy
Aluminum alloy	Copper lead, SAE 480	Lead base babbitt
Copper lead, SAE 480	Cadmium Nickel	*Copper lead, SAE 49
*Copper lead, SAE 49	Lead base babbitt	Cadmium nickel
*Silver	Tin base babbitt	Copper lead, SAE 480

* without overlay

** with overlay

In some applications the babbitt material may be cast instead of plated, but again the surface is kept thin. In this case the babbitt must be finish machined.

A question which normally arises at this time is what happens if and when the thin babbitt surface wears through. In the first place, this wear-through period is considerably longer than one would imagine for the babbitt surface has excellent wear characteristics. However, experience has shown that when wear-through does occur, it takes place only over a limited area, and the bronze beneath takes up the bearing job. The importance of having a thin surface layer has already been discussed.

Up to this point, we have said nothing concerning the manufacturing methods used with today's bearing materials. The reader will undoubtedly be familiar with the early heavywall bearings, usually babbitt, cast and bored in place, or even hand-scraped. This practice gave way to the replaceable bearing, still usually babbitt, but cast on a heavy section of brass or bronze. This change represented a step in the right direction, for it made for easier handling and a better product.

A still greater improvement in the art was realized when the bearing material was changed to copper lead, and the backing to a relatively thin strip of steel. This meant not only a less expensive bearing because of economy of materials and manufacture, but also a more satisfactory bearing because of its precision fit in the case or connecting-rod bore. The combination of a babbitt-surfaced, copper-lead alloy, cast on a steel back utilizes to advantage the properties of several materials and represents another major step forward.

The adoption of these precision bearings by the automotive and diesel industry has been due to their advantages of lower cost, longer life, and easier replacement. Their proper utilization depends upon an understanding of several basic principles.

First, the engine builder must maintain good case alignment and the case and rod bores must possess adequate stiffness and strength. The bores themselves should be held to specified limits

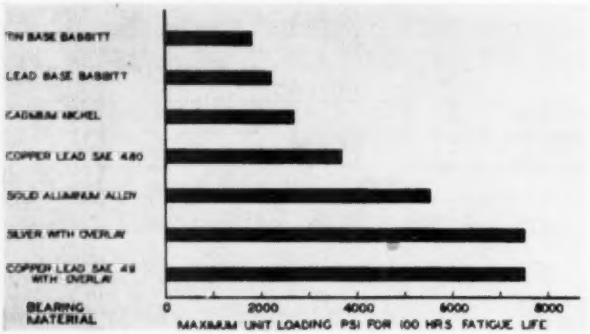


Fig. 3 Various bearing materials rated according to their load-carrying capacities.

of size and machine finish. The case or rod is best bored after the cap has been assembled and the bolts tightened to the predetermined torque reading.

Another consideration for the engine builder is that of crankshaft design, for not to be overlooked is the effect of crankshaft counterbalance on bearing loads.

In gasoline work, where speeds are generally high, the necessity of counterbalancing to reduce bearing loads has been recognized and universally accepted. Rotating speeds are usually lower in the case of even small diesels, but the rotating and reciprocating weights are greater than their gasoline counterparts. Thus counterbalancing on smaller engines should be rather complete, and at least partial on the larger, slow-speed machines.

Secondly, it is highly desirable that the bearing supplier have available the engine speeds, gas pressure loads, shaft diameters, lubrication data, engine operating conditions, and other design data, so that a proper evaluation may be made of the bearing requirements. Experience has shown that the job of recommending bearings for a new engine, or even a design modification, may be laborious indeed. Only close cooperation with the engine builder will insure that all pertinent factors receive due consideration and analysis.

Thirdly, the maintenance man should be familiar with features engineered into the bearing so that if they are replaced at overhaul time, he will have an understanding of the proper procedure. As with any other carefully machined part, the necessity for cleanliness at installation time should be emphasized. This means freedom from foreign material on the bearing back as well as on the bearing surfaces. In the case of the tri-metal type of bearing, the bearing surfaces are very thin and should not be disturbed other than to insure cleanliness.

It is important that the bearings fit tight in the bores after the bolts have been torqued up; in fact, the bearing is designed so that its outside circumference is slightly greater than that of the bore. Thus the ends of the bearing which butt together should not be filed or otherwise altered, or this press fit, known as "crush" will be lost. A loose bearing may lead to early failure due to loss of clearance, excessive temperature, or localized loading. The necessity for drawing up cap bolts evenly and to a specified torque need only be mentioned here.

No discussion of bearings would be complete without recognition of the fact that all bearings require lubrication. Thus the lubricant, as well as the lubrication system, is important from a standpoint of satisfactory bearing performance. With the wider use of diesel engines, lubricants designed for them have appeared. Likewise, the engine builder has recognized the need for adequate lubrication systems, and today considerable attention is being given to pump capacity, and to oil cooling and filtering.

It is not without significance that this last item is receiving more and more attention. Formerly it was felt that partial-flow filtering was adequate in that the oil could be kept sufficiently clean by this method. But recently it has been demonstrated that for good oil condition and better engine life, more thorough filtering is desirable. Thus the trend today is toward full-flow filtration, particularly on the larger engines.

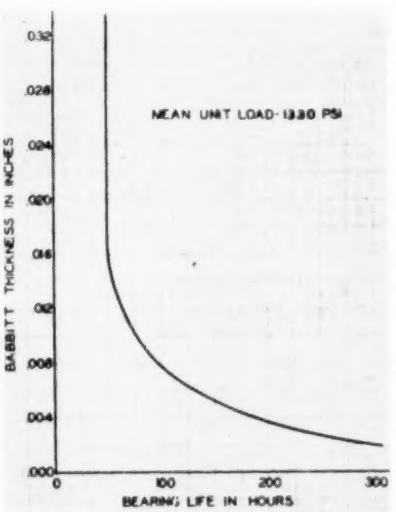
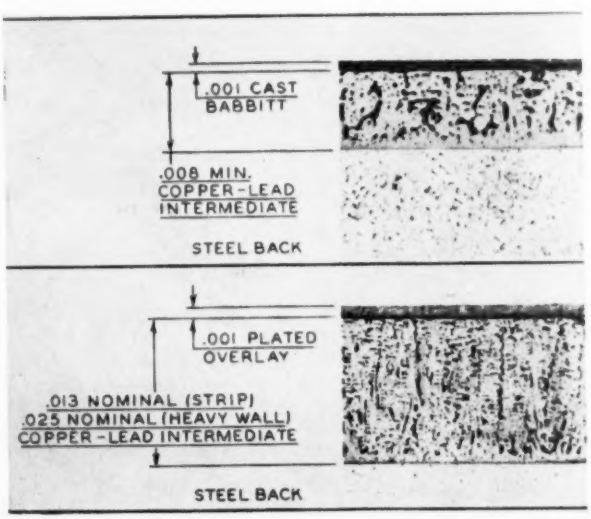


Fig. 4 Interrelation between fatigue life and bearing surface layer thickness.

Photomicrographs of two trimetal bearings.



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ENTERPRISE ENGINE & MACH. CO.
18th & Florida Sts.
San Francisco 10, Calif.

MWM MANNHEIM DIESEL
Ernest L. Frankel Associates
22 E. 40th St.
New York 16, N. Y.

THE NATIONAL SUPPLY CO.
SUPERIOR ENGINE DIVISION
1401 Sheridan Ave.
Springfield 99, Ohio

NORDBERG MFG. CO.
3073 S. Chase Ave.
Milwaukee 7, Wisconsin

THE RATHBUN-JONES ENGINEERING CO.
823 Spencer St.
Toledo 1, Ohio

SULZER BROS. LTD. NEW YORK
50 Church Street
New York 7, N. Y.

THE UNION DIESEL ENGINE CO.
2200 E. 7th St.
Oakland 6, California

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, N. J.

Horsepower, over 1000

ABOE, INC.
Empire State Bldg.
New York 16, N. Y.

AMERICAN LOCOMOTIVE COMPANY
Schenectady 5, N. Y.

THE BALDWIN LOCOMOTIVE WORKS
Eddystone, Pa.

ENTERPRISE ENGINE & MACH. CO.
18th & Florida Sts.
San Francisco 10, Calif.

NORDBERG MFG. CO.
3073 S. Chase Ave.
Milwaukee 7, Wisconsin

SULZER BROS. LTD. NEW YORK
50 Church Street
New York 7, N. Y.

THE UNION DIESEL ENGINE CO.
2200 E. 7th St.
Oakland 6, California

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, N. J.

MEDIUM HIGH SPEED 700 to 1200 r.p.m.

Horsepower, 1 to 50

ABOE, INC.
Empire State Bldg.
New York 16, N. Y.

BURMEISTER & WAIN AMERICAN CORP.
17 Battery Place
New York 4, N. Y.

FAIRBANKS, MORSE & CO.
600 S. Michigan Ave.
Chicago 5, Ill.

HILL DIESEL ENGINE CORP.
238 Mill Street
Lansing, Michigan

THE LATHROP ENGINE CO.
Holmes St.
Mystic, Conn.

LISTER-BLACKSTONE, INC.
858 Graybar Bldg.
420 Lexington Ave.
New York 17, N. Y.

MWM MANNHEIM DIESEL
Ernest L. Frankel Associates
22 East 40th St.
New York 16, N. Y.

WAUKESHA MOTOR CO.
P. O. Box 379
Waukesha, Wisconsin

Horsepower, 51 to 100

ABOE, INC.
Empire State Bldg.
New York 16, N. Y.

THE BUDA COMPANY
154th & Commercial Aves.
Harvey, Illinois

FAIRBANKS MORSE & CO.
600 S. Michigan Ave.
Chicago 5, Ill.

THE LATHROP ENGINE CO.
Holmes St.
Mystic, Conn.

MWM MANNHEIM DIESEL
Ernest L. Frankel Associates
22 East 40th St.
New York 16, N. Y.

THE UNION DIESEL ENGINE CO.
2200 E. 7th St.
Oakland 6, California

WAUKESHA MOTOR CO.
P. O. Box 379
Waukesha, Wisconsin

Horsepower, 101 to 500

ABOE, INC.
Empire State Bldg.
New York 16, N. Y.

THE BUDA COMPANY
154th & Commercial Aves.
Harvey, Illinois

THE COOPER-BESSEMER CORP.
Mt. Vernon, Ohio

ENTERPRISE ENGINE & MACH. CO.
18th & Florida Sts.
San Francisco 10, Calif.

INGERSOLL-RAND CO.
11 Broadway
New York, N. Y.

LIMA-HAMILTON CORP.
545 North Third St.
Hamilton, Ohio

MWM MANNHEIM DIESE
Ernest L. Frankl Associates
22 East 40th St.
New York 16, N. Y.

THE NATIONAL SUPPLY CO.
SUPERIOR ENGINE DIVISION
1401 Sheridan Ave.
Springfield 99, Ohio

NORDBERG MFG. CO.
3073 S. Chase Ave.
Milwaukee 7, Wisconsin

STERLING ENGINE COMPANY
1270 Niagara St.
Buffalo 13, N. Y.

THE UNION DIESEL ENGINE CO.
2200 E. 7th St.
Oakland 6, California

WAUKESHA MOTOR CO.
P. O. Box 379
Waukesha, Wisconsin

Horsepower, 501 to 1000

ABOE, INC.
Empire State Building
New York 16, N. Y.

AMERICAN LOCOMOTIVE COMPANY
Schenectady 5, N. Y.

COOPER-BESSEMER CORP.
Mt. Vernon, Ohio

INGERSOLL-RAND CO.
11 Broadway
New York 4, N. Y.

LIMA-HAMILTON CORP.
545 North Third St.
Hamilton, Ohio

NORDBERG MFG. CO.
3073 S. Chase Ave.
Milwaukee 7, Wisconsin

Horsepower, 501 to 1000 (cont.)

STERLING ENGINE COMPANY
1270 Niagara St.
Buffalo 13, N. Y.

Horsepower, over 1000

AMERICAN LOCOMOTIVE COMPANY
Schenectady 5, N. Y.

THE COOPER-BESSEMER CORP.
Mt. Vernon, Ohio

LIMA-HAMILTON CORP.
545 North Third St.
Hamilton, Ohio

HIGH SPEED, over 1200 r.p.m.

Horsepower, 1 to 50

ABOE, INC.
Empire State Bldg.
New York 16, N. Y.

THE BUDA COMPANY
154th & Commercial Aves.
Harvey, Illinois

CONTINENTAL MOTORS CORP.
205 Market St.
Muskegon, Michigan

FAIRBANKS, MORSE & CO.
600 S. Michigan Ave.
Chicago 5, Ill.

HERCULES MOTORS CORP.
Canton 2, Ohio

HILL DIESEL ENGINE CORP.
238 Mill Street
Lansing, Michigan

INTERNATIONAL HARVESTER CO.
180 N. Michigan Ave.
Chicago 1, Ill.

LISTER-BLACKSTONE, INC.
858 Graybar Bldg.
420 Lexington Ave.
New York 17, N. Y.

MWM MANNHEIM DIESEL
Ernest L. Frankel Associates
22 E. 40th St.
New York 16, N. Y.

NORDBERG MFG. CO.
3073 S. Chase Ave.
Milwaukee 7, Wisconsin

R. H. SHEPPARD CO., INC.
101 Philadelphia St.
Hanover, Pa.

THE UNION DIESEL ENGINE CO.
2200 E. 7th St.
Oakland 6, California

WAUKESHA MOTOR CO.
P. O. Box 379
Waukesha, Wisconsin

Horsepower, 51 to 100

ABOE INC.
Empire State Bldg.
New York 16, N. Y.

THE BUDA COMPANY
154th & Commercial Aves.
Harvey, Illinois

CONTINENTAL MOTORS CORP.
205 Market St.
Muskegon, Mich.

CUMMINS ENGINE CO., INC.
Columbus, Indiana

FAIRBANKS, MORSE & CO.
600 S. Michigan Ave.
Chicago 5, Ill.

HERCULES MOTORS CORP.
Canton 2, Ohio

HILL DIESEL ENGINE CORP.
238 Mill St.
Lansing, Mich.

INTERNATIONAL HARVESTER CO.
180 N. Michigan Ave.
Chicago 1, Ill.

MWM MANNHEIM DIESEL
Ernest L. Frankl Associates
22 E. 40th St
New York 16, N. Y.

R. H. SHEPPARD CO., INC.
101 Philadelphia St.
Hanover, Pa.

STERLING ENGINE COMPANY
1270 Niagara St.
Buffalo 13, N. Y.

THE UNION DIESEL ENGINE CO.
2200 E. 7th St.
Oakland 6, California

WAUKESHA MOTOR CO.
P. O. Box 379
Waukesha, Wisconsin

Horsepower, 101 to 500

ABOE INC.
Empire State Bldg.
New York 16, N. Y.

THE BUDA COMPANY
154th & Commercial Aves.
Harvey, Illinois

CONTINENTAL MOTORS CORP.
205 Market St.
Muskegon, Mich.

CUMMINS ENGINE CO., INC.
Columbus, Indiana

HERCULES MOTORS CORP.
Canton 2, Ohio

INTERNATIONAL HARVESTER CO.
180 N. Michigan Ave.
Chicago 1, Ill.

THE LATHROP ENGINE CO.
Holmes St.
Mystic, Conn.

MACK MANUFACTURING CORP.
Empire State Bldg.
New York 1, N. Y.

MWM MANNHEIM DIESEL
Ernest L. Frankl Associates
22 East 40th St.
New York 16, N. Y.

STERLING ENGINE COMPANY
1270 Niagara St.
Buffalo 13, N. Y.

THE UNION DIESEL ENGINE CO.
2200 E. 7th St.
Oakland 6, California

WAUKESHA MOTOR CO.
P. O. Box 379
Waukesha, Wisconsin

Horsepower, 501 to 1000

CUMMINS ENGINE CO., INC.
Columbus, Indiana

DIESEL PLANT ACCESSORIES

Adapters, Engine Indicator

BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett Street
Pittsburgh 8, Pa.

Additives

See also "Fuel Oil Additives"; "Fuel Oil Treatment, Diesel"

LUBAL, INC.
375 West Rich Street
Columbus 8, Ohio

Air Cleaners

See also "Air Filters"; "Filters, Air"; etc.

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

AMERICAN AIR FILTER CO., INC.
445 Central Ave.
Louisville 8, Ky.

VORTOX CO., INC.
Claremont, Calif.

Air Cleaners, Oil Washed

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

AMERICAN AIR FILTER CO., INC.
445 Central Ave.
Louisville 8, Ky.

DONALDSON CO., INC.
666 Pelham Blvd.
St. Paul 4, Minn.

Air Compressor Oils

SOCONY VACUUM OIL CO.
26 Broadway
New York 4, N. Y.

Air Compressors

See also "Compressors, Air"; "Starting Units, Engine Driven Air Compressors"

THE COOPER-BESSEMER CORP.
Mount Vernon, Ohio

INGERSOLL-RAND CO.
11 Broadway
New York 4, N. Y.

QUINCY COMPRESSOR CO.
217 Main Street
Quincy, Ill.

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, N. J.

Air Compressors, Diesel Driven

FAIRBANKS, MORSE & CO.
600 S. Michigan Avenue
Chicago 5, Illinois

GRIFFIN EQUIPMENT CORP.
880 E. 141 St.
New York 54, N. Y.

INGERSOLL-RAND CO.
11 Broadway
New York 4, N. Y.

Air Compressors, Diesel Starting

FAIRBANKS, MORSE & CO.
600 S. Michigan Avenue
Chicago 5, Illinois

INGERSOLL-RAND CO.
11 Broadway
New York 4, N. Y.

QUINCY COMPRESSOR CO.
217 Main Street
Quincy, Ill.

JOHN REINER & CO.
12-12 37th Ave.
Long Island City 1, N. Y.

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, New Jersey

Air Dryers, Instrument

J. F. PRITCHARD & CO.
908 Grand Ave.
Kansas City, Mo.

Air Filters

See also "Air Cleaners"; "Filters, Air"; etc.

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

AMERICAN AIR FILTER CO., INC.
445 Central Ave.
Louisville 8, Ky.

FARR COMPANY
2615 Southwest Drive
Los Angeles 43, Calif.

Air Filters, Automatic Self Cleaning

CONTINENTAL AIR FILTERS, INC.
P. O. Box 1647
Louisville 1, Ky.

Air Filters, Crankcase

See also "Breather Caps"; etc.

FRAM CORP.
Providence 16, R. I.

Air Filters, Washable Unit

CONTINENTAL AIR FILTERS, INC.
P. O. Box 1647
Louisville 1, Ky.

Air Velocity Meters

ILLINOIS TESTING LABORATORIES, INC.
420 N. LaSalle Street
Chicago 10, Ill.

Air Washers

CONTINENTAL AIR FILTERS, INC.
P. O. Box 1647
Louisville 1, Ky.

Aircraft Lubricants

SHELL OIL COMPANY
50 West 50th St.
New York 20, N. Y.

SHELL OIL COMPANY
100 Bush Street
San Francisco 6, Calif.

Alarm Systems, Pressure & Temperature

PENN ELECTRIC SWITCH CO.
Goshen, Indiana

SYNCHRO START PRODUCTS, INC.
8151 N. Ridgeway Ave.
Skokie, Ill.

Alloy Steel Bolts & Nuts

See also "Bolts"; "Engine Bolts"; "Nuts and Studs"; "Special . . . Studs"; "Connecting Rod Bolts & Nuts"

ERIE BOLT & NUT COMPANY
Erie, Pa.

Ammeters

See also "Meters, Electrical Indicating"; "Volt-Ammeter, Clamp-On Type"

BURLINGTON INSTRUMENT CO.
203 N. 3rd St.
Burlington, Iowa

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

ROCHESTER MFG. CO., INC.
100 Rockwood Street
Rochester 10, N. Y.

WESTON ELECTRICAL INSTRUMENT CORP.
614 Frelinghuysen Ave.
Newark 5, N. J.

Ammeters—Tong Test (Clamp On) Type

COLUMBIA ELECTRIC MFG. CO.
4519 Hamilton Ave.
Cleveland 14, Ohio

Anti-Rust Compounds

See also "Rust Preventatives"

CITIES SERVICE OIL CO.
60 Wall Tower
New York 5, N. Y.

Asbestos, Sheet

VICTOR MFG. & GASKET CO.
5750 W. Roosevelt Road
Chicago 50, Ill.

Automotive Diesel Fuel

See also "Fuel Oil, Diesel"; "Oils, Diesel Fuel"; "Diesel Fuel Oils"; "Motor Fuels"

STANDARD OIL CO. OF CALIFORNIA
225 Bush Street
San Francisco, Calif.

THE TEXAS COMPANY
135 East 42nd Street
New York 17, N. Y.

Automotive Oils

SHELL OIL COMPANY
50 West 50th St.
New York 20, N. Y.

SHELL OIL COMPANY
100 Bush Street
San Francisco 6, Calif.

Automotive Greases

See also "Greases," "Lubricants"

SHELL OIL COMPANY
50 West 50th St.
New York 20, N. Y.

SHELL OIL COMPANY
100 Bush Street
San Francisco 6, Calif.

Auxiliary Combination Units

ABOE INC.
Empire State Bldg.
New York 16, N. Y.

FAIRBANKS, MORSE & CO.
600 S. Michigan Avenue
Chicago 5, Illinois

GRIFFIN EQUIPMENT CORP.
880 East 141st Street
New York 54, N. Y.

JOHN REINER & CO.
12-12 37th Ave.
Long Island City 1, N. Y.

STEWART & STEVENSON SERVICES
4516 Harrisburg Blvd.
Houston 11, Texas

Auxiliary Diesel Generating Sets

See also "Diesel Generating Sets"; "Generating Sets, Electric"; "Emergency Diesel Generator Systems"; "Emergency Lighting Plants"; "Packaged Generators"

ABOE INC.
Empire State Bldg.
New York 16, N. Y.

THE COOPER-BESSEMER CORP.
Mount Vernon, Ohio

INTERNATIONAL DIESEL ELECTRIC CO., INC.
13-02 44th Avenue
Long Island City 1, N. Y.

Babbitt Metal

JOHNSON BRONZE CO.
470 South Mill Street
New Castle, Pa.

NATIONAL BEARING DIVISION
American Brake Shoe Co.
St. Louis 10, Missouri

Balancing Machines, Static

TAYLOR DYNAMOMETER & MACHINE CO.
528 W. Highland Ave.
Milwaukee 3, Wis.

Ball Bearings

See also "Bearings, Ball"

SKF INDUSTRIES, INC.
Front St. & Erie Ave.
P. O. Box 6731
Philadelphia 32, Pa.

Bars, Bronze

See also "Bronze Bar Stock"

JOHNSON BRONZE COMPANY
470 S. Mill St.
New Castle, Pa.

Batteries, Diesel Locomotive

See also "Starting Batteries, Storage"

ELECTRIC STORAGE BATTERY CO.
19th St. & Allegheny Ave.
Philadelphia 32, Pa.

Batteries, Diesel Starting

See also "Starting Batteries, Storage"

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

ELECTRIC STORAGE BATTERY CO.
19th St. & Allegheny Ave.
Philadelphia 32, Pa.

GLOBE UNION INC.
900 E. Keefe Ave.
Milwaukee 1, Wisc.

Batteries, Electric Storage

DELCO-REMY DIVISION
GENERAL MOTORS CORPORATION
Anderson, Indiana

Batteries, Marine Storage

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

ELECTRIC STORAGE BATTERY CO.
19th St. & Allegheny Ave.
Philadelphia 32, Pa.

Batteries, Stationary Storage

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

ELECTRIC STORAGE BATTERY CO.
19th St. & Allegheny Ave.
Philadelphia 32, Pa.

Battery Service Accessories

ELECTRIC STORAGE BATTERY CO.
19th St. & Allegheny Ave.
Philadelphia 32, Pa.

Bearings, Aluminum

FEDERAL-MOGUL CORP.
11031 Shoemaker Ave.
Detroit 13, Michigan

JOHNSON BRONZE CO.
470 South Mill Street
New Castle, Pa.

Bearings, Ball

See also "Ball Bearings"

LINK-BELT COMPANY
519 North Holmes Ave.
Indianapolis 6, Indiana

Bearings, Bronze

See also "Bronze Bearings"

THE BUNTING BRASS & BRONZE CO.
715 Spencer Street
Toledo 9, Ohio

THE CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Avenue
Cleveland 10, Ohio

FEDERAL-MOGUL CORP.
11031 Shoemaker Ave.
Detroit 13, Michigan

JOHNSON BRONZE CO.
470 South Mill Street
New Castle, Pa.

NATIONAL BEARING DIVN.
AMERICAN BRAKE SHOE CO.
St. Louis 10, Missouri

Bearings, Bronze and Steel, Babbitt-Lined

CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Ave.
Cleveland 10, Ohio

FEDERAL-MOGUL CORP.
11031 Shoemaker Ave.
Detroit 13, Michigan

JOHNSON BRONZE CO.
470 South Mill Street
New Castle, Pa.

LINK-BELT COMPANY
2410 West 18th Street
Chicago 8, Ill.

NATIONAL BEARING DIVN.
AMERICAN BRAKE SHOE CO.
St. Louis 10, Missouri

Bearings, Copper-Lead

FEDERAL-MOGUL CORPORATION
11031 Shoemaker Ave.
Detroit 13, Mich.

Bearings, Lead-Bronze

BUNTING BRASS & BRONZE CO.
715 Spencer Street
Toledo 9, Ohio

CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Ave.
Cleveland 10, Ohio

FEDERAL-MOGUL CORP.
11031 Shoemaker Ave.
Detroit 13, Mich.

JOHNSON BRONZE CO.
470 S. Mill St.
New Castle, Pa.

NATIONAL BEARING DIVN.
AMERICAN BRAKE SHOE CO.
St. Louis 10, Mo.

Bearings, Piston Pin

See also "Piston Pin Bearings"

CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Ave.
Cleveland 10, Ohio

FEDERAL-MOGUL CORP.
11031 Shoemaker Ave.
Detroit 13, Michigan

JOHNSON BRONZE CO.
470 South Mill Street
New Castle, Pa.

NATIONAL BEARING DIVN.
AMERICAN BRAKE SHOE CO.
St. Louis 10, Missouri

Bearings, Roller

LINK-BELT CO.
519 North Holmes Ave.
Indianapolis 6, Indiana

Bearings, Roller, Cylindrical Spherical

LINK-BELT CO.
519 North Holmes Ave.
Indianapolis 6, Indiana

Bearings, Self-Lubricating

BUNTING BRASS & BRONZE CO.
715 Spencer Street
Toledo 9, Ohio

CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Ave.
Cleveland 10, Ohio

JOHNSON BRONZE CO.
470 South Mill Street
New Castle, Pa.

Bearings, Sleeve, Copper-Lead Lined

CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Ave.
Cleveland 10, Ohio

FEDERAL-MOGUL CORP.
11031 Shoemaker Ave.
Detroit 13, Michigan

JOHNSON BRONZE CO.
470 South Mill Street
New Castle, Pa.

Bearings, Steel Back, Copper-Lead Lined

JOHNSON BRONZE COMPANY
470 S. Mill Street
New Castle, Pa.

Bearings, Steel Back, Copper-Lead and Cast or Plated Babbitt Lined

JOHNSON BRONZE COMPANY
470 S. Mill Street
New Castle, Pa.

Bellows Metallic

CHICAGO METAL HOSE CORP.
1315 So. 3d Ave.
Maywood, Illinois

Bellows, Stainless Steel

ZALLEA BROS.
Taylor & Locust Sts.
Wilmington, Del.

Belting, Chain

LINK-BELT CO.
220 South Belmont Ave.
Indianapolis 6, Indiana

Belting, V-Type

LINK-BELT CO.
220 South Belmont Ave.
Indianapolis 6, Indiana

Beverage & Truck Bodies

STEWART & STEVENSON SERVICES
4516 Harrisburg Blvd.
Houston 11, Texas

Blowers and Compressors, Scavenging and Supercharging

See also "Supercharging Blowers"; other headings under "Blowers"; "Turbochargers and Superchargers"

DE LAVAL STEAM TURBINE CO.
Trenton 2, N. J.

INGERSOLL-RAND COMPANY
11 Broadway
New York, N. Y.

ROOTS-CONNERSVILLE BLOWER CORP.
Connersville, Indiana

Blowers, Centrifugal

DR. ALFRED J. BUCHI
Engineering Office
Winterthur, Switzerland
U. S. Office, 520 Munsey Bldg.
Washington 4, D. C.

Blowers, Scavenging and Supercharging

DR. ALFRED J. BUCHI
Engineering Office
Winterthur, Switzerland
U. S. Office, 520 Munsey Bldg.
Washington 4, D. C.

Blowers, Scavenging-Oil and Gas Engine

DE LAVAL STEAM TURBINE CO.
Trenton 2, N. J.

Boilers, Exhaust Gas

See also "Exhaust Gas Economizer"; "Waste Heat Boilers"

MAXIM SILENCER CO.
85 Homestead Ave.
Hartford 5, Conn.

Boilers, Waste Heat

See note under heading above.

MAXIM SILENCER CO.
85 Homestead Ave.
Hartford 5, Conn.

Bolts

See also "Alloy Steel Bolts and Nuts"; "Engine Bolts, Studs & Nuts"; "Special . . . Studs"; "Connecting Rod Bolts & Nuts"

ERIE BOLT & NUT COMPANY
Erie, Pa

Brazing, Copper, Atmospheric

BURGESS-NORTON MFG. CO.
Geneva, Ill.

Breather Caps

See also "Air Filters, Crankcase"

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

Breather Filters

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

Breathers, Crankcase

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

DONALDSON CO., INC.
666 Pelham Blvd.
St. Paul 4, Minn.

Bronze Bar Stock, Completely Finished

See also "Bars, Bronze"

JOHNSON BRONZE CO.
470 South Mill Street
New Castle, Pa.

Bronze Bar Stock, Semi-Finished

BUNTING BRASS & BRONZE CO.
715 Spencer Street
Toledo 9, Ohio

FEDERAL MOGUL CORP.
11031 Shoemaker Ave.
Detroit 13, Michigan

NATIONAL BEARING DIVN.
AMERICAN BRAKE SHOE CO.
St. Louis 10, Missouri

Bronze Bearings

See also "Bearings, Bronze"

BUNTING BRASS & BRONZE CO.
715 Spencer Street
Toledo 9, Ohio

THE CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Avenue
Cleveland 10, Ohio

FEDERAL-MOGUL CORP.
11031 Shoemaker Ave.
Detroit 13, Mich.

NATIONAL BEARING DIVISION
AMERICAN BRAKE SHOE CO.
St. Louis 10, Missouri

Bronze Washers

See also "Washers"

BUNTING BRASS & BRONZE CO.
715 Spencer Street
Toledo 9, Ohio

CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Ave.
Cleveland 10, Ohio

FEDERAL-MOGUL CORP.
11031 Shoemaker Ave.
Detroit 13, Michigan

JOHNSON BRONZE CO.
470 South Mill Street
New Castle, Pa.

Bushings, Allan Red Metal, Copper—Lead Rough Castings

A. ALLAN & SON
603 Bergen Street
Harrison, N. J.

Bushings, Bronze

BUNTING BRASS & BRONZE CO.
715 Spencer Street
Toledo 9, Ohio

CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Ave.
Cleveland 10, Ohio

FEDERAL-MOGUL CORP.
11031 Shoemaker Ave.
Detroit 13, Michigan

JOHNSON BRONZE CO.
470 South Mill St.
New Castle, Pa.

Bushings, Hard-Rolled Bronze

JOHNSON BRONZE COMPANY
470 S. Mill Street
New Castle, Pa.

Bushings, Steel

FEDERAL-MOGUL CORP.
11031 Shoemaker Ave.
Detroit 13, Mich.

Bushings, Steel Back, Babbitt Lined

JOHNSON BRONZE COMPANY
470 S Mill Street
New Castle, Pa.

Bushings, Steel Back, Lead-Bronze Lined

JOHNSON BRONZE COMPANY
470 S. Mill Street
New Castle, Pa.

Cables, Battery

ELECTRIC STORAGE BATTERY CO.
19th St. & Allegheny Ave.
Philadelphia 32, Pa.

Can Making Machinery

LIMA-HAMILTON CORP.
545 N. Third St.
Hamilton, Ohio

Carbon Solvents

LUBAL, INC.
375 West Rich Street
Columbus 8, Ohio

Cast Camshafts

CAMPBELL, WYANT & CANNON FOUNDRY CO.
Muskegon 83, Mich.

Cast Crankshafts

See also "Crankshafts".

CAMPBELL, WYANT & CANNON FOUNDRY CO.
Muskegon 83, Mich.

Castings Bronze, Brass and Aluminum

JOHNSON BRONZE CO.
470 South Mill Street
New Castle, Pa.

NATIONAL BEARING DIVN.
AMERICAN BRAKE SHOE CO.
St. Louis 10, Missouri

Castings, Centrifugal

CENTRIFUGAL FOUNDRY CO.
Muskegon, Mich.

Castings, Gray Iron (Centrifugal)

See also "Gray Iron and Steel Castings".

CENTRIFUGAL FOUNDRY CO.
Muskegon, Mich.

Castings, Malleable Iron

LINK-BELT CO.
220 South Belmont Ave.
Indianapolis 6, Indiana

Centrifugal Purifiers, Fuel Oil

See also "Oil Purification Systems, Centrifugal".

THE DE LAVAL SEPARATOR CO.
165 Broadway
New York 6, N. Y.

THE SHARPLES CORP.
2300 Westmoreland St.
Philadelphia 40, Pa.

Centrifugal Purifiers, Lube Oil

See heading above.

THE DE LAVAL SEPARATOR CO.
165 Broadway
New York 6, N. Y.

THE SHARPLES CORP.
2300 Westmoreland St.
Philadelphia 40, Pa.

Centrifuse Brake Drums

CAMPBELL, WYANT & CANNON FDRY. CO.
Muskegon 83, Michigan

Chains, Control

DIAMOND CHAIN CO., INC.
402 Kentucky Avenue
Indianapolis 7, Indiana

LINK-BELT COMPANY
220 So. Belmont Ave.
Indianapolis 6, Indiana

MORSE CHAIN CO.
7601 Central Avenue
Detroit 8, Mich.

Chains, Dual Engine Drive

See also "Dual Engine Chain Drives".

DIAMOND CHAIN CO., INC.
402 Kentucky Avenue
Indianapolis 7, Indiana

LINK-BELT CO.
220 South Belmont Ave.
Indianapolis 6, Indiana

Chains, Power Transmission

DIAMOND CHAIN CO., INC.
402 Kentucky Avenue
Indianapolis 7, Indiana

LINK-BELT CO.
220 South Belmont Ave.
Indianapolis 6, Indiana

MORSE CHAIN CO.
7601 Central Ave.
Detroit 8, Mich.

Chains, Roller

DIAMOND CHAIN CO., INC.
402 Kentucky Avenue
Indianapolis 7, Indiana

LINK-BELT CO.
220 South Belmont Ave.
Indianapolis 6, Indiana

MORSE CHAIN CO.
7601 Central Ave.
Detroit 8, Mich.

Chains, Silent

LINK-BELT CO.
220 South Belmont Ave.
Indianapolis 6, Indiana

MORSE CHAIN CO.
7601 Central Ave.
Detroit 8, Mich.

Chains, Timing

DIAMOND CHAIN CO., INC.
402 Kentucky Avenue
Indianapolis 7, Indiana

LINK-BELT CO.
220 South Belmont Ave.
Indianapolis 6, Indiana

MORSE CHAIN CO.
7601 Central Ave.
Detroit 8, Mich.

Chargers, Battery

ELECTRIC STORAGE BATTERY CO.
19th St. & Allegheny Ave.
Philadelphia 32, Pa.

Chromate Corrosion Inhibitors

MUTUAL CHEMICAL CO. OF AMERICA
270 Madison Avenue
New York 16, N. Y.

Chromium Treated Parts

KOPPERS COMPANY, INC.
METAL PRODUCTS DIVISION
Bush and Hamburg Sts.
P.O.B. 626
Baltimore 3, Md.

Cleaning Compounds

MAGNUS CHEMICAL CO., INC.
91 South Ave.
Garwood, New Jersey

OAKITE PRODUCTS, INC.
22 Thames Street
New York 6, N. Y.

Cleaning Machines (Diesel Engine Parts)

MAGNUS CHEMICAL CO., INC.
91 South Ave.
Garwood, New Jersey

Clutch Discs

CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Ave.
Cleveland 10, Ohio

Clutches

CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Ave.
Cleveland 10, Ohio

MORSE CHAIN CO.
7601 Central Ave.
Detroit 8, Mich.

ROCKFORD CLUTCH DIVN.
BORG-WARNER CORP.
1301 Eighteenth Ave.
Rockford, Illinois

TWIN DISC CLUTCH CO.
1328 Racine
Racine, Wisconsin

Clutches, Free Wheeling

MORSE CHAIN CO.
7601 Central Avenue
Detroit 8, Mich.

Clutches, Friction and Jaw

FAWICK AIRFLEX CO., INC.
9919 Clinton Road
Cleveland 11, Ohio

LINK-BELT CO.
300 W. Pershing Rd.
Chicago 9, Ill.

MORSE CHAIN CO.
7601 Central Ave.
Detroit 8, Mich.

ROCKFORD CLUTCH DIVN.
BORG-WARNER CORP.
1301 Eighteenth Ave.
Rockford, Illinois

TWIN DISC CLUTCH CO.
1328 Racine
Racine, Wisconsin

Clutches, Hydraulic

TWIN DISC CLUTCH CO.
Hydraulic Division
Rockford, Ill.

Clutches, Pneumatic

FAWICK AIRFLEX CO., INC.
9919 Clinton Road
Cleveland 11, Ohio

TWIN DISC CLUTCH CO.
1328 Racine
Racine, Wisconsin

Collector, Pre-Cleaner

DONALDSON COMPANY, INC.
666 Pelham Blvd.
St. Paul 4, Minn.

Combustion Systems, Design

LANOVA CORP.
38-15 30th Street
Long Island City 1, N. Y.

Compression Testers, Diesel Engine

See also "Indicators, Diesel Engine".

BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett St.
Pittsburgh 8, Pa.

KIENE DIESEL ACCESSORIES CO.
10352 Pacific Ave.
Franklin Park, Illinois

Compressors, Air

See also "Air Compressors"; "Starting Units, Engine Driven Air Compressor".

INGERSOLL-RAND CO.
11 Broadway
New York 4, N. Y.

Compressors, Reciprocating, Air and Gas, All Drives

THE COOPER-BESSEMER CORP.
Mount Vernon, Ohio

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, New Jersey

Conditioners, Fuel & Lube Oil

See also "Reclaimers, Oil"; headings under "Purifiers"; headings under "Oil".

THE HILLIARD CORP.
120 West 4th St.
Elmira, N. Y.

Connecting Rod Bolts & Nuts

See also "Bolts"; "Engine Bolts, Nuts & Studs; "Special . . . Studs"; "Alloy Steel Bolts & Nuts".

THE CHICAGO SCREW CO.
2701 Washington Blvd.
Bellwood, Ill.

ERIE BOLT & NUT CO.
Erie, Pa.

Connecting Rods

ELLWOOD CITY FORGE CO.
Ellwood City, Pa.

NATIONAL FORGE & ORDNANCE CO.
Irvine, Warren Co., Pa.

Connecting Rods, Finished Machined

THE CAREY MACHINE CO.
9518 Cassius Ave.
Cleveland 5, Ohio

Controls, Automatic Starting

AUTOMATIC SWITCH COMPANY
391 Lakeside Avenue
Orange, New Jersey

R. H. SHEPPARD CO.
101 Philadelphia St.
Hanover, Pa.

SYNCHRO START PRODUCTS, INC.
8151 N. Ridgeway Ave.
Skokie, Illinois

Controls, Pressure

THE MERCOID CORPORATION
4201 Belmont Avenue
Chicago 41, Illinois

PENN ELECTRIC SWITCH CO.
Goshen, Indiana

UNITED ELECTRIC CONTROLS CO.
85 School Street
Watertown 72, Mass.

Controls, Temperature

THE MERCOID CORPORATION
4201 Belmont Avenue
Chicago 41, Illinois

PENN ELECTRIC SWITCH CO.
Goshen, Indiana

THE POWERS REGULATOR CO.
2710 Greenview Ave.
Chicago 14, Ill.

UNITED ELECTRIC CONTROLS CO
85 School Street
Watertown 72, Mass.

Coolers, Evaporative Type

See headings under "Evaporators".

BINKS MFG. CO.
3114 Carroll Ave.
Chicago 12, Illinois

BUFFALO FORGE CO.
473 Broadway
Buffalo, N. Y.

FAIRBANKS, MORSE & CO.
600 S. Michigan Avenue
Chicago 5, Illinois

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, New Jersey

YOUNG RADIATOR COMPANY
Racine, Wisconsin

Coolers, Jacket Water

See also "Exchangers, Heat"; "Water Cooling Equipment"; and headings under "Heat Exchangers".

AEROFIN CORPORATION
410 S. Geddes St.
Syracuse 4, N. Y.

BINKS MFG. CO.
3114 Carroll Ave.
Chicago 12, Ill.

BUFFALO FORGE CO.
473 Broadway
Buffalo, N. Y.

THE FLUOR CORP.
403 W. Eighth St.
Los Angeles 22, Calif.

HARRISON RADIATOR DIV.
GENERAL MOTORS CORP.
Washburn Street
Lockport, New York

THE MARLEY COMPANY, INC.
Fairfax and Marley Roads
Kansas City 15, Kansas

J. F. PRITCHARD & CO.
908 Grand Avenue
Kansas City, Missouri

ROSS HEATER & MFG. CO., INC.
1405 West Avenue
Buffalo 13, N. Y.

STRUTHERS-WELLS CORP.
Warren, Pa.

YOUNG RADIATOR CO.
Racine, Wisconsin

Coolers, Oil and Water

See also "Oil Coolers"; "Water Cooling Equipment"; "Exchangers, Heat" and headings under "Heat Exchangers".

AEROFIN CORPORATION
410 S. Geddes St.
Syracuse 4, N. Y.

BINKS MFG. CO.
3114 Carroll Ave.
Chicago 12, Ill.

THE FLUOR CORP.
403 W. Eighth St.
Los Angeles 22, Calif.

HARRISON RADIATOR DIV.
GENERAL MOTORS CORP.
Washburn Street
Lockport, New York

J. F. PRITCHARD & CO.
908 Grand Avenue
Kansas City , Missouri

ROSS HEATER & MFG. CO., INC.
1405 West Avenue
Buffalo 13, N. Y.

STRUTHERS-WELLS CORP.
Warren, Pa.

YOUNG RADIATOR CO.
Racine, Wisconsin

Cooling Towers

See also "Towers, Cooling"; "Spray Towers".

BINKS MFG. CO.
3114 Carroll Ave.
Chicago 12, Ill.

THE FLUOR CORP.
403 W. Eighth St.
Los Angeles 22, Calif.

LILIE-HOFFMANN COOLING TOWERS, INC.
4239 Duncan
St. Louis 10, Missouri

THE MARLEY COMPANY, INC.
Fairfax and Marley Roads
Kansas City 15, Kansas

J. F. PRITCHARD & CO.
908 Grand Ave.
Kansas City 6, Missouri

Core Oils

CITIES SERVICE OIL CO.
60 Wall Tower
New York 5, N. Y.

Corrosion Inhibitors

MUTUAL CHEMICAL CO. OF AMERICA
270 Madison Avenue
New York 16, N. Y.

Couplings, Chain

DIAMOND CHAIN CO., INC.
402 Kentucky Avenue
Indianapolis 7, Indiana

LINK-BELT CO.
220 So. Belmont Ave.,
Indianapolis, Ind.

MORSE CHAIN CO.
7601 Central Ave.
Detroit 8, Mich.

Couplings, Cutout Type

FAWICK AIRFLEX CO., INC.
9919 Clinton Road
Cleveland 11, Ohio

Couplings, Flexible

AJAX FLEXIBLE COUPLING CO., INC.
139 English Street
Westfield, New York

DE LAVAL STEAM TURBINE CO.
Trenton 2, N. J.

DIAMOND CHAIN CO., INC.
402 Kentucky Avenue
Indianapolis 7, Indiana

KOPPERS CO., INC.
METAL PRODUCTS DIVISION
Bush and Hamburg Sts.
P.O.B. 626
Baltimore 3, Md.

LINK-BELT CO.
220 So. Belmont Ave.,
Indianapolis 6, Ind.

LOVEJOY FLEXIBLE COUPLING CO.
5009 West Lake Street
Chicago 44, Illinois

MORSE CHAIN CO.
7601 Central Avenue
Detroit 8, Mich.

THOMAS FLEXIBLE COUPLING CO.
P. O. Box 658
Warren, Pa.

Couplings, Floating Shaft Type

KOPPERS CO., INC.
METAL PRODUCTS DIVISION
Bush and Hamburg Sts.
P. O. Box 626
Baltimore 3, Md.

MORSE CHAIN CO.
7601 Central Ave.
Detroit 8, Mich.

THOMAS FLEXIBLE COUPLING CO.
P. O. Box 658
Warren, Pa.

Couplings, Hydraulic

AERO-COUPLING CORP.
1051-53 Hollywood Way
Burbank, Calif.

AEROQUIP CORP.
Jackson, Michigan

GUSTIN-BACON MFG. CO.
Kansas City 7, Mo.

LINK-BELT CO.
220 So. Belmont Ave.,
Indianapolis, Ind.

TWIN DISC CLUTCH CO.
Hydraulic Division
Rockford, Ill.

Couplings, Hydraulic, Quick Disconnect, Automatic Self Sealing

THE BRUNING CO.
1210 P. Street
Lincoln, Nebraska

Couplings, Self-Aligning

KOPPERS CO., INC.
METAL PRODUCTS DIVISION
Bush and Hamburg Sts.
P.O.B. 626
Baltimore 3, Md.

LINK-BELT CO.
220 So. Belmont Ave.,
Indianapolis, Ind.

THOMAS FLEXIBLE COUPLING CO.
P. O. Box 658
Warren, Pa.

Couplings, Self-Sealing

AERO-COUPLING CORP.
1051-53 Hollywood Way
Burbank, Calif.

AEROQUIP CORP.
Jackson, Michigan

Crankshaft Alignment Indicator

LISTER-BLACKSTONE, INC.
858 Graybar Bldg.
420 Lexington Ave.
New York 17, N. Y.

Crankshaft Bearings

See also headings under "Bearings".

CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Ave.
Cleveland 10, Ohio

JOHNSON BRONZE COMPANY
470 S. Mill Street
New Castle, Pa.

Crankshaft Grinders

LEMPCO PRODUCTS, INC.
5490 Dunham Rd.
Bedford, Ohio

Crankshaft, Machinists

NATIONAL FORGE & ORDNANCE CO.
Irvine, Warren Co., Pa.

Crankshafts

See also "Cast Crankshafts".

ELLWOOD CITY FORGE CO.
Ellwood City, Pa.

NATIONAL FORGE & ORDNANCE CO.
Irvine, Warren Co., Pa.

Crankshafts, Emergency Repairs

BRODIE SYSTEM
115 Clifton Place
Brooklyn 5, N. Y.

NATIONAL FORGE & ORDNANCE CO.
Irvine, Warren Co., Pa.

Crankshafts, Thermit Welded

BRODIE SYSTEM
115 Clifton Place
Brooklyn 5, N. Y.

Crawler Tractors, 4 Cycle, High Speed, 31.3 to 148 DHP

INTERNATIONAL HARVESTER CO.
180 N. Michigan Ave.
Chicago 1, Ill.

Cutting Fluids

SOCONY-VACUUM OIL CO.
26 Broadway
New York 4, N. Y.

THE TEXAS COMPANY
135 E. 42d St.
New York 17, N. Y.

Cutting Oils

THE PURE OIL CO.
35 East Wacker Drive
Chicago 1, Illinois

SINCLAIR REFINING CO.
630 Fifth Ave.
New York 20, N. Y.

THE TEXAS COMPANY
135 E. 42d St.
New York 17, N. Y.

TIDE WATER ASSOCIATED OIL CO.
17 Battery Place
New York 4, N. Y.

Cutting Tools, Precision

BROWN & SHARPE MFG. CO.
235 Promenade Street
Providence 8, Rhode Island

Cylinder Blocks

CAMPBELL, WYANT & CANNON FOUNDRY CO.
Muskegon 83, Mich.

Cylinder Heads

CAMPBELL, WYANT & CANNON FOUNDRY CO.
Muskegon 83, Mich.

Cylinder Heads Repaired

RALPH STARK, INC.
43-12 33rd St.
Long Island City, N. Y.

Cylinder Liners

CAMPBELL, WYANT & CANNON FOUNDRY CO.
Muskegon 83, Mich.

CENTRIFUGAL FOUNDRY CO.
Muskegon, Mich.

JANNEY CYLINDER COMPANY
7425 State Road
Holmesburg, Philadelphia 36, Pa.

KOPPERS COMPANY, INC.
METAL PRODUCTS DIVISION
Bush & Hamburg Sts.
P.O.B. 626
Baltimore 3, Md.

SEALED POWER CORP.
Muskegon 61, Michigan

Cylinder Sleeves

JANNEY CYLINDER COMPANY
7425 State Road
Holmesburg, Philadelphia 36, Pa.

Cylinders, Bored & Finished

BRODIE SYSTEM
115 Clifton Place
Brooklyn 5, N. Y.

Cylinders, Hydraulic, Single or Double Action

THE BRUNING CO.
1210 P. Street
Lincoln, Nebraska

Dampers, Torsional Vibration

SCHWITZER-CUMMINS CO.
1125 Massachusetts Ave.
Indianapolis 7, Indiana

Dehydrators, Diesel Fuel

WARNER LEWIS CO.
817 N. Lewis Place
Tulsa 8, Okla.

Detergents

LUBAL, INC.
375 W. Rich St.
Columbus 8, Ohio

Detonation Indicator

ELECTRO PRODUCTS LABORATORIES INC.
4501 N. Ravenswood Ave.
Chicago 40, Ill.

Dew Point Meters

ILLINOIS TESTING LABORATORIES, INC.
420 No. La Salle St.
Chicago 10, Ill.

Diesel Buses

MACK MFG. CORP.
Empire State Bldg.
New York 1, N. Y.

Diesel Engine Lubricating Oil

See also "Lubricating Oils".

STANDARD OIL CO. OF CALIFORNIA
225 Bush Street
San Francisco, Calif.

THE TEXAS COMPANY
135 East 42nd Street
New York 17, N Y.

Diesel Engines, New

See also "Engines, Diesel, New".

ENTERPRISE ENGINE & MACHINE CO.
18th & Florida Streets
San Francisco 10, Calif.

HARNISCHFEGER CORPORATION
Diesel Division
100 Lake St.
Port Washington, Wisconsin

HERCULES MOTORS CORP.
Canton 2, Ohio

Diesel Engines, Reconditioned

CLEVELAND DIESEL ENGINE DIVN.
GENERAL MOTORS CORP.
2160 W. 106th St.
Cleveland 11, Ohio

GRIFFIN EQUIPMENT CORP.
880 E. 141 St.
New York 54, N. Y.

R. H. SHEPPARD CO.
101 Philadelphia St.
Hanover, Pa.

STEWART & STEVENSON SERVICES
4516 Harrisburg Blvd.
Houston 11, Texas

WOLVERINE MOTOR WORKS INC.
42 Union Ave.
Bridgeport, Conn.

Diesel Farm Tractors—Wheel Type-Row Crop-2 and 3 Plow Sizes

R. H. SHEPPARD & CO.
101 Philadelphia St.
Hanover, Pa.

Diesel Fuel Oil

See also "Automotive Diesel Fuel"; "Fuel Oil, Diesel"; "Oils, Diesel Fuel"; "Motor Fuels".

ALLIED OIL COMPANY, INC.
1700 Standard Bldg.
Cleveland 1, Ohio

SHELL OIL CO.
50 West 50th St.
New York 20, N. Y.

SHELL OIL CO.
100 Bush St.
San Francisco 6 Cal.

SINCLAIR REFINING CO.
630 5th Ave.
New York 20, N. Y.

STANDARD OIL CO. OF CALIF.
225 Bush Street
San Francisco 20, Calif.

THE TEXAS COMPANY
135 E. 42d St.
New York 17, N. Y.

Diesel Fuel Oil Tar and Carbon Dispersing Agent

LUBAL, INC.
375 West Rich Street
Columbus 8, Ohio

Diesel Generating Sets

See also "Auxiliary Diesel Generating Sets"; "Emergency Diesel Generator Systems"; "Emergency Lighting Plants"; "Generating Sets Electric"; "Packaged Generators".

ABOE INC.
Empire State Bldg.
New York 16, N. Y.

BOLINDERS CO., INC.
33 Rector Street
New York 6, N. Y.

CLEVELAND DIESEL ENGINE DIVN.
GENERAL MOTORS CORP.
2160 W. 106th St.
Cleveland 11, Ohio

THE COOPER-BESSEMER CORP.
Mount Vernon, Ohio

DETROIT DIESEL ENGINE DIV.
GENERAL MOTORS CORP.
13400 W. Outer Drive
Detroit 28, Mich.

ENTERPRISE ENGINE & MACH. CO.
18th & Florida Streets
San Francisco 10, Calif.

FAIRBANKS, MORSE & CO.
600 S. Michigan Avenue
Chicago 5, Ill.

GRIFFIN EQUIPMENT CORP.
880 E. 141 St.
New York 54, N. Y.

INGERSOLL-RAND CO.
11 Broadway
New York 4, N. Y.

INTERNATIONAL DIESEL ELECTRIC CO., INC.
13-02 44th Avenue
Long Island City 1, N. Y.

NORDBERG MFG. CO.
3073 South Chase Ave.
Milwaukee 7, Wisconsin

JOHN REINER & CO.
12-12 37th Ave.
Long Island City 1, N. Y.

R. H. SHEPPARD CO.
101 Philadelphia St.
Hanover, Pa.

WOLVERINE MOTOR WORKS INC.
42 Union Ave.
Bridgeport, Conn.

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, N. J.

Diesel Industrial Tractors

R. H. SHEPPARD CO.
101 Philadelphia St.
Hanover, Pa.

Diesel Locomotives

See also headings under "Locomotives".

ABOE INC.
Empire State Bldg.
New York 16, N. Y.

GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.

Diesel Nozzle Testers

See also "Nozzle Testers".

AMERICAN BOSCH CORP.
3664 Main St.
Springfield 7, Mass.

Diesel Orchard Tractors

R. H. SHEPPARD CO.
101 Philadelphia St.
Hanover, Pa.

Diesel Power Units

See also headings under "Portable" and "Power Units".

HERCULES MOTORS CORP.
Canton 2, Ohio

Diesel Pumping Units

See also "Pumping Units, Diesel".

JOHN REINER & CO.
12-12 37th Ave.
Lona Island City 1, N. Y.

Diesel Railway Generating Sets

WAUKESHA MOTOR CO.
P. O. Box 379
Waukesha, Wisc.

Diesel Schools

ADCOX SCHOOL
237 N. E. Broadway
Portland 12, Oregon

HEMPHILL DIESEL SCHOOLS
31-28 Queens Boulevard
Long Island City, N. Y.

Diesel Testing Equipment

AUTOMOTIVE PRODUCTS, INC.
1700 Southeast Grand Ave.
Portland 14, Ore.

Diesel Truck-Tractors

MACK MFG. CORP.
Empire State Bldg.
New York 1, N. Y.

Drilling Machine (Sensitive) Precision

TAYLOR DYNAMOMETER & MACHINE CO.
528 W. Highland Ave.
Milwaukee 3, Wis.

Drills, Portable Electric

SNAP-ON TOOLS CORP.
8064 28th Avenue
Kenosha, Wisconsin

Drives, Adjustable Speed

RELIANCE ELECTRIC & ENGINEERING CO.
1088 Ivanhoe Road
Cleveland 10, Ohio

Drives, Chain

DIAMOND CHAIN CO., INC.
402 Kentucky Avenue
Indianapolis 7, Indiana

LINK-BELT CO.
220 South Belmont Ave.
Indianapolis 6, Indiana

MORSE CHAIN CO.
7601 Central Ave.
Detroit 8 Mich.

Drives, Electrofluid

LINK-BELT CO.
2045 West Hunting Park Ave.
Philadelphia 40, Pa.

Drives, Gearmotor

LINK-BELT CO.
2045 West Hunting Park Ave.
Philadelphia 40, Pa.

Drives, V-Belt

LINK-BELT CO.
220 South Belmont Ave.
Indianapolis 6, Indiana

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, N. J.

Dual Engine Chain Drives

See also "Chain, Dual Engine Drives".

DIAMOND CHAIN CO., INC.
402 Kentucky Avenue
Indianapolis 7, Indiana

LINK-BELT CO.
220 South Belmont Ave.
Indianapolis 6, Indiana

MORSE CHAIN CO.
7601 Central Avenue
Detroit 8, Mich.

Dynamometers and Prony Brakes

GENERAL ELECTRIC CO.
One River Road
Schenectady 5, N. Y.

TAYLOR DYNAMOMETER & MACHINE CO.
528 W. Highland Ave.
Milwaukee 3, Wis.

Electrical Connectors

SCINTILLA MAGNETO DIV.
BENDIX AVIATION CORP.
Sidney, New York

Emergency Diesel Generator Systems

See also "Auxiliary Diesel Generator Sets"; "Diesel Generating Sets"; "Emergency Lighting Plants"; "Generating Set, Electric"; "Packaged Generators".

DETROIT DIESEL ENGINE DIV.
GENERAL MOTORS CORP.
13400 W. Outer Drive
Detroit 28, Mich.

FAIRBANKS, MORSE & CO.
600 S. Michigan Ave.
Chicago 5, Illinois

INTERNATIONAL DIESEL ELECTRIC CO., INC.
13-02 44th Avenue
Long Island City 1, N. Y.

Emergency Lighting Plants

See also heading above.

ELECTRIC STORAGE BATTERY CO.
19th St. & Allegheny Ave.
Philadelphia 32, Pa.

GRIFFIN EQUIPMENT CORP.
880 E. 141 St.
New York 54, N. Y.

INTERNATIONAL DIESEL ELECTRIC CO., INC.
13-02 44th Avenue
Long Island City 1, N. Y.

D. W. ONAN & SONS, INC.
University Ave. S. E. at 25th
Minneapolis 14, Minn.

JOHN REINER & CO.
12-12 37th Ave.
Long Island City 1, N. Y.

R. H. SHEPPARD CO.
101 Philadelphia St.
Hanover, Pa.

Engine Bolts, Nuts & Studs

See also "Bolts"; "Alloy Steel Bolts and Nuts"; "Special . . . Studs"; "Connecting Rod Bolts & Nuts".

ERIE BOLT & NUT COMPANY
Erie, Pa.

Engine Cooling System Cleaners

OAKITE PRODUCTS, INC.
22 Thames Street
New York 6, N. Y.

YOUNG RADIATOR COMPANY
Racine, Wisconsin

Engine Cooling System Rust Preventatives

SOCONY-VACUUM OIL CO.
26 Broadway
New York 4, N. Y.

YOUNG RADIATOR COMPANY
Racine, Wisconsin

Engines, Diesel New

See also "Diesel Engines, New".

AMERICAN LOCOMOTIVE CO.
Schenectady 5, New York

HERCULES MOTORS CORP.
Canton 2, Ohio

WAUKESHA MOTOR CO.
P. O. Box 379
Waukesha, Wisconsin

Engines, Diesel, New, Used

ABOE INC.
Empire State Bldg.
New York 16, N. Y.

CLEVELAND DIESEL ENGINE DIVN.
GENERAL MOTORS CORP.
2160 W. 106th St.
Cleveland 11, Ohio

COOPER-BESSEMER CORP.
Mount Vernon, Ohio

WOLVERINE MOTOR WORKS INC.
42 Union Ave.
Bridgeport, Conn.

Engine Service Tools

KENT-MOORE ORGANIZATION, INC.
5-105 General Motors Bldg.
Detroit 2, Michigan

Engine Stands

KENT-MOORE ORGANIZATION, INC.
5-105 General Motors Bldg.
Detroit 2, Michigan

Evaporators

See also "Coolers, Evaporative Type".

YOUNG RADIATOR COMPANY
Racine, Wisconsin

Evaporators, Exhaust Gas

MAXIM SILENCER CO.
85 Homestead Ave.
Hartford 5, Conn.

Evaporators, Steam

MAXIM SILENCER CO.
85 Homestead Ave.
Hartford 5, Conn.

Exchangers, Heat

See also "Water Cooling Equipment" and headings under "Coolers" and "Heat Exchangers".

BINKS MFG. CO.
3114 Carroll Ave.
Chicago 12, Ill.

THE FLUOR CORP.
403 W. 8th St.
Los Angeles 22, Calif.

HARRISON RADIATOR DIVISION
GENERAL MOTORS CORP.
Washburn Street
Lockport, New York

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, New Jersey

YOUNG RADIATOR CO.
Racine, Wisconsin

Exchangers, Heat, Materials for Cleaning

OAKITE PRODUCTS, INC.
22 Thames Street
New York 6, N. Y.

Exciters

GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.

Exhaust Gas Economizer

See also headings under "Boilers"; "Waste Heat Boilers".

THE FLUOR CORP.
403 W. 8th St.
Los Angeles 22, Calif.

Expansion Joints, Corrugated Stainless Steel

ZALLEA BROS.
Taylor & Locust Sts.
Wilmington, Del.

Fans, Axial Flow

BUFFALO FORGE CO.
473 Broadway
Buffalo, N. Y.

Fans, Centrifugal

BUFFALO FORGE CO.
473 Broadway
Buffalo, N. Y.

Fans, Radiator Cooling

SCHWITZER-CUMMINS CO.
1125 Massachusetts Ave.
Indianapolis 7, Indiana

Farm Implements

R. H. SHEPPARD CO.
101 Philadelphia Street
Hanover, Penna.

Fill Signals

SCULLY SIGNAL CO.
88 First St.
Cambridge, Mass.

Filtering Systems

ENGINE LIFE PRODUCTS CORP.
115 So. Granada Ave.
El Monte, California

Filters, Air

See also "Air Cleaners"; "Air Filters"; "Breather Caps", etc.

A. C. SPARK PLUG DIVN.
GENERAL MOTORS CORP.
Flint 3, Michigan

Filters, Air, Automatic Self-Cleaned

AMERICAN AIR FILTER CO., INC.
445 Central Ave.
Louisville 8, Ky.

DOLLINGER CORP.
11 Centre Park
Rochester 3, N. Y.

Filters, Air, Compressed

CHICAGO MANUFACTURING & DISTRIBUTING CO.
1932 W. 46th St.
Chicago 9, Ill.

COMMERCIAL FILTERS CORP.
18 W. Third St.
Boston 27, Mass.

Filters, Air, Dry Type

AMERICAN AIR FILTER CO., INC.
445 Central Ave.
Louisville 8, Ky.

DOLLINGER CORP.
11 Centre Park
Rochester 3, N. Y.

Filters, Air, Dry Type (Crankcase)

FRAM CORP.
Providence 16, Rhode Island

Filters, Air, Intake

DOLLINGER CORP.
11 Centre Park
Rochester 3, N. Y.

Filters, Air, Materials for Cleaning

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

AMERICAN AIR FILTER CO., INC.
445 Central Ave.
Louisville 8, Ky.

OAKITE PRODUCTS, INC.
22 Thames Street
New York 6, N. Y.

Filters, Air, Oil Bath Type

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

AMERICAN AIR FILTER CO., INC.
445 Central Ave.
Louisville 8, Ky.

DONALDSON COMPANY, INC.
666 Pelham Blvd.
Saint Paul 4, Minn.

Filters, Air, Open-Screen Type

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

AMERICAN AIR FILTER CO., INC.
445 Central Ave.
Louisville 8, Ky.

Filters, Air, Panel Type

AMERICAN AIR FILTER CO., INC.
445 Central Ave.
Louisville 8, Ky.

FARR COMPANY
2615 Southwest Drive
Los Angeles 43, Calif.

Filters (Centrifugal) Lubricating Oil

THE DE LAVAL SEPARATOR CO.
165 Broadway
New York 6, N. Y.

Filters, 5-Micron, Diesel Fuel

WARNER LEWIS CO.
817 N. Lewis Place
Tulsa 8, Okla.

Filters, Fuel Oil

See also "Oil Filters".

A. C. SPARK PLUG DIVN.
GENERAL MOTORS CORP.
Flint 3, Michigan

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

AMERICAN BOSCH CORP.
3664 Main Street
Springfield 7, Mass.

BRIGGS FILTRATION COMPANY
Washington 16, D. C.

C. A. V. LIMITED
Acton, London, W. 3, England

COMMERCIAL FILTERS CORP.
18 West Third Street
Boston 27, Mass.

CUNO ENGINEERING CORP.
80 South Vine Street
Meriden, Conn.

ENGINE LIFE PRODUCTS CORP.
115 So. Granada Ave.
El Monte, Calif.

FRAM CORP.
Providence 16, Rhode Island

THE HILLIARD CORP.
120 West 4th Street
Elmira, N. Y.

WILIAM W. NUGENT & CO.
410 No. Hermitage Ave.
Chicago 22, Ill.

PUROLATOR PRODUCTS, INC.
970 New Brunswick Ave.
Rahway, N. J.

UNITED STATES HOFFMAN MACHINERY CORP.
Filtration Division
219 Lamson Street
Syracuse 6, N. Y.

WINSLOW ENGINEERING CO.
4069 Hollis Street
Oakland 8, Calif.

Filters, Gasoline

DOLLINGER CORP.
11 Centre Park
Rochester 3, N. Y.

FRAM CORP.
Providence 16, R. I.

Filters, Lubricating Oil

See also "Oil Filters".

A. C. SPARK PLUG DIVN.
GENERAL MOTORS CORP.
Flint 3, Michigan

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

BRIGGS FILTRATION COMPANY
Washington 16, D. C.

COMMERCIAL FILTERS CORP.
18 West Third Street
Boston 27, Mass.

CUNO ENGINEERING CORP.
80 South Vine Street
Meriden, Conn.

ENGINE LIFE PRODUCTS CORP.
115 So. Granada Ave.
El Monte, Calif.

FRAM CORP.
Providence 16, Rhode Island

THE HILLIARD CORP.
120 West 4th Street
Elmira, N. Y.

MICHIANA PRODUCTS CORP.
Michigan City, Indiana

WILLIAM W. NUGENT & CO.
410 N. Hermitage Ave.
Chicago 22, Ill.

PUROLATOR PRODUCTS, INC.
970 New Brunswick Ave.
Rahway, N. J.

U. S. HOFFMAN MACHINERY CORP.
FILTRATION DIVISION
219 Lamson Street
Syracuse 6, N. Y.

WINSLOW ENGINEERING CO.
4069 Hollis Street
Oakland 8, Calif.

Filters, Lubricating Oil, Magnetic

WINSLOW ENGINEERING CO.
4069 Hollis Street
Oakland 8, Calif.

Filters, Panel Type

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

Filters, Silencer, Dry Type

DOLLINGER CORP.
11 Centre Park
Rochester 3, N. Y.

Filters Silencer, Oil Bath Type

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

AMERICAN AIR FILTER CO., INC.
445 Central Ave.
Louisville 8, Ky.

Fire Extinguishers, Dry Chemical Type

GUSTIN-BACON MFG. CO.
Kansas City 7, Mo.

Fittings, Hose, Detachable

AERO-COUPLING CORP.
1051-53 Hollywood Way
Burbank, Calif.

AEROQUIP CORP.
Jackson, Michigan

Flexible Connections, Stainless Steel

See also headings under "Hose" and "Tubing".

CHICAGO METAL HOSE CORP.
1315 So. 3rd Ave.
Maywood, Illinois

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.
7217 Powers Lane
Philadelphia 42, Pa.

TITEFLEX, INC.
515 Frelinghuysen Ave.
Newark 5, N. J.

ZALLEA BROS.
Taylor & Locust Street
Wilmington, Del.

Flexible Drives

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Flexible Exhaust Connections

See also headings under "Hose" and "Tubing".

ALLIED METAL HOSE CO.
37-46 Ninth Street
Long Island City 1, N. Y.

THE AMERICAN BRASS CO.
AMERICAN METAL HOSE BRANCH
Waterbury 20, Conn.

ATLANTIC METAL HOSE CO. INC.
123 W. 64th St.
New York 23, N. Y.

CHICAGO METAL HOSE CORP.
1315 So. 3rd Ave.
Maywood, Illinois

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.
7217 Powers Lane
Philadelphia 42, Pa.

TITEFLEX, INC.
515 Frelinghuysen Ave.
Newark 5, N. J.

ZALLEA BROS.
Taylor & Locust Street
Wilmington, Del.

Flexible Metal Hose, Fuel Oil, Lubricating Oil, Compressed Air

See also headings under "Hose" and "Tubing".

THE AMERICAN BRASS CO.
AMERICAN METAL HOSE BRANCH
Waterbury 20, Conn.

ATLANTIC METAL HOSE CO., INC.
123 West 64th Street
New York 23, N. Y.

CHICAGO METAL HOSE CORP.
1315 So. 3rd Ave.
Maywood, Illinois

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.
7217 Powers Lane
Philadelphia 48, Pa.

TITEFLEX, INC.
515 Frelinghuysen Ave.
Newark 5, N. J.

ZALLEA BROS.
Taylor & Locust Streets
Wilmington, Del.

Flexible Shielded Conduits

THE AMERICAN BRASS CO.
AMERICAN METAL HOSE BRANCH
Waterbury 20, Conn.

Flowmeters, Recorders & Controllers

FISCHER & PORTER COMPANY
County Line Road
Hatboro, Pa.

Fluid Drive

AMERICAN BLOWER CORP.
Detroit 32, Michigan

LINK-BELT CO.
2045 West Hunting Park Ave.
Philadelphia, Pa.

Forgings, Drop

WYMAN-GORDON COMPANY
Worcester 1, Mass.

Forgings, Iron and Steel

ELLWOOD CITY FORGE CO.
Ellwood City, Pa.

NATIONAL FORGE & ORDNANCE CO.
Irvine, Warren Co., Pa.

Frequency Controls

BURLINGTON INSTRUMENT CO.
203 N. 3rd St.
Burlington, Iowa

Fuel Injection Systems, Repair & Service

See also "Injection Systems, Service".

A & D DIESEL SERVICE, INC.
677 Fourth Ave.
Brooklyn 32, N. Y.

HANCOCK MACHINE CO.
300 Walnut St.
Findlay, Ohio

Fuel Injection Tubing

See also "Steel Tubing, Fuel Injection."

SUMMERILL TUBING COMPANY DIV.
P. O. Box 1557
Pittsburgh 30, Penna.

Fuel Oil Additives

See also "Additives"; "Fuel Oil Treatment, Diesel".

LUBAL, INC.
375 West Rich Street
Columbus 8, Ohio

VISCOSITY OIL CO.
3820 West Pershing Road
Chicago 32, Illinois

Fuel Oil, Diesel

See also "Automotive Diesel Fuel"; "Oils, Diesel Fuels"; "Diesel Fuel Oil".

CITIES SERVICE OIL CO.
Sixty Wall Tower
New York 5, N. Y.

MID-CONTINENT PETROLEUM CORP.
Tulsa 2, Okla.

THE PURE OIL COMPANY
35 East Wacker Drive
Chicago 1, Illinois

SINCLAIR REFINING CO.
630 Fifth Ave.
New York 20, N. Y.

SOCONY-VACUUM OIL CO.
26 Broadway
New York 4, N. Y.

STANDARD OIL CO. (Indiana)
910 South Michigan Ave.
Chicago 80, Illinois

THE TEXAS COMPANY
135 E. 42d St.
New York 17, N. Y.

TIDE WATER ASSOCIATED OIL CO.
17 Battery Place
New York 4, N. Y.

Fuel Oil Tar and Carbon Dispersing Agent

LUBAL, INC.
375 West Rich Street
Columbus 8, Ohio

Fuel Oil Treatment, Diesel

See also "Additives"; "Fuel Oil Additives".

GAMLEN CHEMICAL CO.
1470 Spring Garden Ave.
Pittsburgh 12, Pa.

LUBAID CO.
3270 S. Third St.
Milwaukee 7, Wisconsin

LUBAL, INC.
375 West Rich Street
Columbus 8, Ohio

Gages, Air Pressure

ROCHESTER MFG. CO., INC.
100 Rockwood Street
Rochester 10, N. Y.

Gages, Draft, Portable Indicating

BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett St.
Pittsburgh 8, Pa.

Gages, Fuel

KING ENGINEERING CORP.
415 Detroit St.
Ann Arbor, Michigan

THE LIQUIDOMETER CORP.
41-03 36th Street
Long Island City 1, N. Y.

ROCHESTER MFG. CO., INC.
100 Rockwood Street
Rochester 10, N. Y.

Gages, Liquid Level

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

KING ENGINEERING CORP.
415 Detroit St.
Ann Arbor, Michigan

Gages, Oil Pressure

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

ROCHESTER MFG. CO., INC.
100 Rockwood Street
Rochester 10, N. Y.

Gages, Tank Contents

KING ENGINEERING CORP.
415 Detroit St.
Ann Arbor, Michigan

THE LIQUIDOMETER CORP.
41-03 36th Street
Long Island City 1, N. Y.

PETROMETER CORPORATION
9 Star Square
Long Island City 1, N. Y.

ROCHESTER MFG. CO., INC.
100 Rockwood Street
Rochester 10, N. Y.

VIKING PUMP COMPANY
Cedar Falls, Iowa

Gages Temperature

ROCHESTER MFG. CO.
100 Rockwood Street
Rochester 10, N. Y.

Gages, Vacuum

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

ROCHESTER MFG. CO., INC.
100 Rockwood Street
Rochester, N Y.

Gaskets

THE FITZGERALD MFG. CO.
Torrington, Conn.

MC CORD CORPORATION
2587 E. Grand Blvd.
Detroit 11, Michigan

Gaskets, Asbestos

THE FITZGERALD MFG. CO.
Torrington, Conn.

METALLO GASKET CO.
10-18 Bethany St.
New Brunswick, N. J.

VICTOR MFG. & GASKET CO.
5750 West Roosevelt Road
Chicago 50, Illinois

Gaskets, Cork

THE FITZGERALD MFG. CO.
Torrington, Conn.

VICTOR MFG. & GASKET CO.
5750 West Roosevelt Road
Chicago 50, Illinois

Gaskets, Fibrous

THE FITZGERALD MFG. CO.
Torrington, Conn.

VICTOR MFG. & GASKET CO.
5750 West Roosevelt Road
Chicago 50, Illinois

Gaskets, Metallic

THE FITZGERALD MFG. CO.
Torrington, Conn.

MC CORD CORPORATION
2587 E. Grand Blvd.
Detroit 11, Michigan

METALLO GASKET CO.
10-18 Bethany St.
New Brunswick, N. J.

VICTOR MFG. & GASKET CO.
5750 West Roosevelt Road
Chicago 50, Illinois

Gaskets, Oil and Water

THE FITZGERALD MFG. CO.
Torrington, Conn.

Gasoline Tanks

DONALDSON COMPANY INC.
666 Pelham Blvd.
St. Paul 4, Minn.

Gearmotors

LINK-BELT COMPANY
2045 West Hunting Park Ave.
Philadelphia 40, Pa.

Gears, Cast

LINK-BELT CO.
2045 West Hunting Park Ave.
Philadelphia 40, Pa.

Gears, Cut

LINK-BELT CO.
2045 West Hunting Park Ave.
Philadelphia 40, Pa.

Gears, Reduction

DE LAVAL STEAM TURBINE CO.
Trenton 2, N. J.

LINK-BELT CO.
2045 West Hunting Park Ave.
Philadelphia 40, Pa.

TWIN DISC CLUTCH CO.
1328 Racine
Racine, Wisconsin

Generating Sets, Electric

See also "Diesel Generator Sets"; "Auxiliary Diesel Generating Sets"; "Emergency Diesel Generating Systems"; "Emergency Lighting Plants"; "Packaged Generators".

DETROIT DIESEL ENGINE DIV.
GENERAL MOTORS CORP.
13400 W. Outer Drive
Detroit 28, Mich.

INTERNATIONAL DIESEL ELECTRIC CO., INC.
13-02 44th Avenue
Long Island City 1, N. Y.

R. H. SHEPPARD CO.
101 Philadelphia Street
Hanover, Pa.

WOLVERINE MOTOR WORKS INC.
42 Union Ave.
Bridgeport, Conn.

Generators, A. C.

COLUMBIA ELECTRIC MFG. CO.
4519 Hamilton Ave.
Cleveland 14, Ohio

DELCO PRODUCTS DIVN.
GENERAL MOTORS CORP.
329 E. First St.
Dayton 1, Ohio

ELECTRIC MACHINERY MFG. CO.
1331 Tyler St., N.E.
Minneapolis 13, Minn.

FAIRBANKS, MORSE & CO.
600 S. Michigan Avenue
Chicago 5, Illinois

GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.

Generators, Charging

THE ELECTRIC AUTOLITE CO.
Toledo 1, Ohio

GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.

Generators, Charging—Direct Current, Rectified A.C.

THE LEECE-NEVILLE CO.
5109 Hamilton Ave.
Cleveland 14, Ohio

Generators, D. C.

AMERICAN BOSCH CORP.
3664 Main Street
Springfield 7, Mass.

COLUMBIA ELECTRIC MFG. CO.
4519 Hamilton Ave.
Cleveland 14, Ohio

DELCO PRODUCTS DIV.
GENERAL MOTORS CORP.
328 E. First St.
Dayton 1, Ohio

DELCO-REMY DIV.
GENERAL MOTORS CORP.
Anderson, Indiana

FAIRBANKS, MORSE & CO.
600 S. Michigan Ave.
Chicago 5, Illinois

GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.

Generators, Diesel Engine Driven

CONSOLIDATED DIESEL ELECTRIC CORP.
230 E. 8th St.
Mt. Vernon, N. Y.

Generators, Engine Driven

ABOE INC.
Empire State Bldg.
New York 16, N. Y.

CLEVELAND DIESEL ENGINE DIVN.
GENERAL MOTORS CORP.
2160 West 106th St.
Cleveland 11, Ohio

DELCO PRODUCTS DIVN.
GENERAL MOTORS CORP.
329 E. First St.
Dayton 1, Ohio

DETROIT DIESEL ENGINE DIV.
GENERAL MOTORS CORP.
13400 W. Outer Drive
Detroit 28, Mich.

FAIRBANKS, MORSE & CO.
600 S. Michigan Ave.
Chicago 5, Ill.

GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.

D. W. ONAN & SONS, INC.
University Ave. S. E. at 25th
Minneapolis 14, Minn.

STEWART & STEVENSON SERVICES
4516 Harrisburg Blvd.
Houston 11, Texas

WOLVERINE MOTOR WORKS INC.
42 Union Ave.
Bridgeport, Conn.

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, N. J.

Governors, Centrifugal

C. A. V. LIMITED
Acton, London, W. 3, England

PIERCE GOVERNOR CO.
1625 Ohio Ave.
Anderson, Indiana

Governors, Hydraulic

THE MARQUETTE METAL PRODS. CO.
1145 Galewood Drive
Cleveland 10, Ohio

PIERCE GOVERNOR CO.
1625 Ohio Ave.
Anderson, Indiana

WOODWARD GOVERNOR CO.
Rockford, Illinois

Governors, Overspeed, Engine Shut-Off

THE MARQUETTE METAL PRODS. CO.
1145 Galewood Drive
Cleveland 10, Ohio

PIERCE GOVERNOR CO.
1625 Ohio Ave.
Anderson, Indiana

SYNCHRO START PRODS., INC.
8151 N. Ridgeway Ave.
Skokie, Ill.

Greases

See also "Lubricants"; "Industrial Greases."

CITIES SERVICE OIL CO.
Sixty Wall Tower
New York 5, N. Y.

D-A LUBRICANT CO., INC.
1311 West 29th Street
Indianapolis, Indiana

GULF OIL CORP.
GULF REFINING CO.
3702 Gulf Bldg.
Pittsburgh 30, Pa.

MID-CONTINENT PETROLEUM CORP.
Tulsa 2, Okla.

THE PURE OIL CO.
35 East Wacker Drive
Chicago 1, Illinois

SINCLAIR REFINING CO.
630 Fifth Ave.
New York 20, N. Y.

SOCONY-VACUUM OIL CO.
26 Broadway
New York 4, N. Y.

STANDARD OIL CO. (Indiana)
910 South Michigan Ave.
Chicago, Illinois

THE TEXAS COMPANY
135 E. 42d St.
New York 17, N. Y.

VALVOLINE OIL COMPANY
Freedom, Pa.

Grey Iron and Steel Castings

See also "Castings, Grey Iron (Centrifugal)".

CAMPBELL, WYANT & CANNON FOUNDRY CO.
Muskegon 83, Michigan

Hangers, Ball-Bearing

LINK-BELT CO.
519 North Holmes Ave.
Indianapolis 6, Indiana

Hardened and Ground Parts

THE CHICAGO SCREW CO.
2701 Washington Blvd.
Bellwood, Ill.

Heat Exchanger Cleaners

OAKITE PRODUCTS, INC.
22 Thames St.
New York 6, N. Y.

Heat Exchangers, Air Cooled

AEROFIN CORPORATION
410 S. Geddes Street
Syracuse 4, N. Y.

AMERICAN LOCOMOTIVE CO.
Schenectady 5, N. Y.

ENGINEERING CONTROLS CO.
2835 E. 11th St.
Los Angeles 23, Calif.

THE FLUOR CORP.
403 W. 8th St.
Los Angeles 22, Calif.

HARRISON RADIATOR DIVISION
GENERAL MOTORS CORP.
Washburn Street
Lockport 10, N. Y.

THE MARLEY CO., INC.
Fairfax and Marley Roads
Kansas City 15, Kansas

J. F. PRITCHARD & CO.
908 Grand Ave.
Kansas City 6, Missouri

Heat Exchangers, Industrial

AMERICAN LOCOMOTIVE COMPANY
Schenectady 5, N. Y.

Heat Exchangers, Oil & Water

J. F. PRITCHARD & CO.
908 Grand Ave.
Kansas City 6, Missouri

Heat Exchangers, Oil and Water Cooling

See also headings under "Coolers"; "Exchangers, Heat"; "Water Cooling Equipment"; etc.

AEROFIN CORPORATION
410 S. Geddes Street
Syracuse 4, N. Y.

BINKS MFG. CO.
3114 Carroll Ave.
Chicago 12, Ill.

ENGINEERING CONTROLS CO.
2835 E. 11th St.
Los Angeles 23, Calif.

THE FLUOR CORP.
403 W. 8th St.
Los Angeles 22, Calif.

HARRISON RADIATOR DIV.
GENERAL MOTORS CORP.
Washburn Street
Lockport, N. Y.

ROSS HEATER & MFG. CO., INC.
1405 West Ave.
Buffalo 13, N. Y.

STRUTHERS-WELLS CORP.
Warren, Pennsylvania

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, N. J.

YOUNG RADIATOR CO.
Racine, Wisconsin

Heaters

GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.

HUNTER MANUFACTURING CO.
1544 East 17th St.
Cleveland 14, Ohio

ROSS HEATER & MFG. CO., INC.
1405 West Ave.
Buffalo 13, N. Y.

Heaters, Cab and Space

HARRISON RADIATOR DIVISION
GENERAL MOTORS CORP.
Washburn Street
Lockport, N. Y.

HUNTER MANUFACTURING CO.
1544 East 17th St.
Cleveland 14, Ohio

YOUNG RADIATOR CO.
Racine, Wisc.

Heaters, Coolant

HUNTER MANUFACTURING CO.
1544 East 17th St.
Cleveland 14, Ohio

PERFECTION STOVE COMPANY
Cleveland 4, Ohio

Heaters, Direct Fired Air

PERFECTION STOVE COMPANY
Cleveland 4, Ohio

Heaters, Feed Water

AMERICAN LOCOMOTIVE CO.
Schenectady 5, N. Y.

Helixhaust Water Cooled Manifolds

THE STEWART IRON WORKS CO.
P. O. Box 1039
Cincinnati 1, Ohio

Honing Tools

AMMCO TOOLS, INC.
2100 Commonwealth Ave.
North Chicago, Illinois

MICROMATIC HONE CORP.
8100 Schoolcraft
Detroit 4, Michigan

Horns, Air and Electrical

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Hose, Flexible

AERO-COUPLING CORP.
1051-53 Hollywood Way
Burbank, Calif.

AEROQUIP CORP.
Jackson, Michigan

Hose, Flexible Assemblies

See also headings under "Flexible" and "Tubing".

AERO-COUPLING CORP.
1051-53 Hollywood Way
Burbank, Calif.

AEROQUIP CORP.
Jackson, Michigan

THE AMERICAN BRASS CO.
AMERICAN METAL HOSE BRANCH
Waterbury 20, Conn.

ATLANTIC METAL HOSE CO. INC.
123 W. 64th Street
New York 23, N. Y.

CHICAGO METAL HOSE CORP.
1315 So. 3rd Ave.
Maywood, Illinois

Hose, Flexible Metallic

See also headings under "Flexible" and "Tubing".

ALLIED METAL HOSE CO.
37-46 9th Street
Long Island City 1, N. Y.

THE AMERICAN BRASS CO.
AMERICAN METAL HOSE BRANCH
Waterbury 20, Conn.

ATLANTIC METAL HOSE CO. INC.
123 W. 64th St.
New York 23, N. Y.

CHICAGO METAL HOSE CORP.
1315 So. 3rd Ave.
Maywood, Illinois

TITEFLEX, INC.
515 Frelinghuysen Ave.
Newark 4, N. J.

ZALLEA BROS.
Taylor & Locust Sts.
Wilmington, Del.

Hose, Metal For Steam, Oil, Compressed Air

See also headings under "Flexible Hose" and "Tubing".

ATLANTIC METAL HOSE CO. INC.
123 W. 64th Street
New York 23, N. Y.

CHICAGO METAL HOSE CORP.
1315 So. 3rd Ave.
Maywood, Illinois

Hoses and Hose Assemblies, Non-Metallic

See also headings under "Flexible" and "Tubing".

RESISTOFLEX CORP.
Belleville 9, New Jersey

Hydraulic Controls

PESCO-PRODUCTS DIVN.
BORG-WARNER CORP.
11610 Euclid Ave.
Cleveland 6, Ohio

Hydraulic Couplings

See also "Couplings, Hydraulic"

AMERICAN BLOWER CORP.
Detroit 32, Michigan

Hydraulic Drives

LINK-BELT CO.
2045 W. Hunting Park Ave.
Philadelphia 40, Pa.

Hydraulic Fluids

GULF OIL CORP.
GULF REFINING CO.
3702 Gulf Bldg.
Pittsburgh 30, Pa.

THE PURE OIL CO.
35 E. Wacker Drive
Chicago 1, Ill.

THE TEXAS COMPANY
135 E. 42d St.
New York 17, N. Y.

TIDE WATER ASSOCIATED OIL CO.
17 Battery Place
New York 4, N. Y.

Hydraulic Motors

DE LAVAL STEAM TURBINE CO.
Trenton 2, N. J.

PESCO-PRODUCTS DIVN.
BORG-WARNER CORP.
11610 Euclid Ave.
Cleveland 6, Ohio

Hydraulic Pumps

See also headings under "Pumps"

PESCO-PRODUCTS DIVN.
BORG-WARNER CORP.
11610 Euclid Ave.
Cleveland 6, Ohio

Hydraulic Torque Converters

TWIN DISC CLUTCH CO.
Hydraulic Division
Rockford, Ill.

Impact Wrenches

INGERSOLL-RAND CO.
11 Broadway
New York, N. Y.

Indicators, Carbon Dioxide, Portable

BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett St.
Pittsburgh 8, Pa.

Indicators, Diesel Engine

See also "Compression Testers, Diesel Engine".

BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett Street
Pittsburgh 8, Pa.

ELECTRO PRODUCTS LABORATORIES, INC.
4501 No. Ravenswood
Chicago 40, Illinois

KIENE DIESEL ACCESSORIES, INC.
10352 Pacific Ave.
Franklin Park, Illinois

Indicators, Oxygen, Portable

BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett St.
Pittsburgh 8, Pa.

Indicators, Pressure Time, Diesel Engine

BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett St.
Pittsburgh 8, Pa.

ELECTRO PRODUCTS LABORATORIES, INC.
4501 No. Ravenswood Ave.
Chicago 40, Illinois

Indicators, Sight Flow

WILLIAM W. NUGENT & CO.
410 N. Hermitage Ave.
Chicago 22, Ill.

Indicators, Speed

BROWN & SHARPE MFG. CO.
235 Promenade Street
Providence 8, Rhode Island

HERMAN H. STICHT CO., INC.
27 Park Place
New York 7, N. Y.

Industrial Greases

See also "Greases," "Lubricants."

SHELL OIL COMPANY
50 West 50th St.
New York 20, N. Y.

SHELL OIL COMPANY
100 Bush Street
San Francisco 6, Calif.

Industrial Oils

See also headings under "Lubricants" and "Greases".

SHELL OIL COMPANY
50 West 50th St.
New York 20, N. Y.

SHELL OIL COMPANY
100 Bush Street
San Francisco 6, Calif.

STANDARD OIL CO. OF CALIFORNIA
225 Bush Street
San Francisco, Calif.

Industrial Wheel Tractors, 4-Cycle, High Speed, 38½ to 52 Engine Hp.

INTERNATIONAL HARVESTER CO.
180 N. Michigan Ave.
Chicago 1, Ill.

Ingots and Billets

NATIONAL FORGE & ORDNANCE CO.
Irvine, Warren Co., Pa.

Injection Systems, Fuel

AMERICAN BOSCH CORP.
3664 Main St.
Springfield 7, Mass.

C. A. V. LIMITED
Acton, London, W.3., England

W. J. CONNELL CO.
121 Brookline Ave.
Boston, Mass.

SCINTILLA MAGNETO DIVN.
BENDIX AVIATION CORP.
Sidney, N. Y.

Injection Systems, Fuel Injector

C. A. V. LIMITED
Acton, London, W.3., England

W. J. CONNELL CO.
121 Brookline Ave.
Boston, Mass.

DIESEL ENGINEERING & MFG. CORP.
200 N. Laflin St.
Chicago 7, Ill.

INTERSTATE DIESEL SERVICE, INC.
5103 Detroit Ave.
Cleveland 2, Ohio

SCINTILLA MAGNETO DIVN.
BENDIX AVIATION CORP.
Sidney, N. Y.

Injection Systems, Fuel, Mail Order Exchange

HANCOCK MACHINE CO.
300 Walnut St.
Findlay, Ohio

Injection Systems, Service

See also "Fuel Injection Systems, Repair & Service".

W. J. CONNELL CO.
121 Brookline Ave.
Boston, Mass.

GRIFFIN EQUIPMENT CORP.
880 E. 141 St.
New York 54, N. Y.

HANCOCK MACHINE CO.
300 Walnut St.
Findlay, Ohio

Injector Test Stand

See also "Nozzle Testers"

BACHRACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett St.
Pittsburgh 8, Pa.

Inspection, Manufacture and Overhaul, for Defects

MAGNAFLUX CORP.
5900 Northwest Highway
Chicago 31, Illinois

Intake Manifolds

THE STEWART IRON WORKS CO.
P. O. Box 1039
Cincinnati 1, Ohio

Intake Silencers—Cleaners, Dry Type

See also "Silencers, Intake".

AIR MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio

DONALDSON CO., INC.
666 Pelham Blvd.
St. Paul 4, Minnesota

Liner Plating, Porous Chrome

SPAR-TAN ENGINEERING COMPANY
Western Licensee—Van der Horst Corp.
2445 Enterprise St.
Los Angeles 21, California

VAN DER HORST CORP. OF AMERICA
Olean, New York

Lock Nuts

COLUMBIA NUT & BOLT CO., INC.
945 Main Street
Bridgeport 3, Conn.

ELASTIC STOP NUT CORP. OF AMERICA
2330 Vauxhall Road
Union, New Jersey

Locomotives, Diesel

See also headings under "Diesel Locomotives".

ABOE, INC.
Empire State Bldg.
New York 16, N. Y.

DAVENPORT-BESLER CORP.
Davenport Locomotive Works
Davenport, Iowa

ELECTRO-MOTIVE DIV.
GENERAL MOTORS CORP.
La Grange, Ill.

THE FATE-ROOT-HEATH COMPANY
Plymouth Locomotive Works
Plymouth, Ohio

INTERNATIONAL DIESEL LOCOMOTIVE CORP.
13-02 44th Avenue
Long Island City 1, N. Y.

Locomotives, Diesel-Electric

See heading above.

ABOE, INC.
Empire State Bldg.
New York 16, N. Y.

AMERICAN LOCOMOTIVE CO.
Schenectady 5, N. Y.

DAVENPORT-BESLER CORP.
Davenport Locomotive Works
Davenport, Iowa

ELECTRO-MOTIVE DIVN.
GENERAL MOTORS CORP.
La Grange, Illinois

FAIRBANKS, MORSE & CO.
600 S. Michigan Ave.
Chicago 5, Illinois

GENERAL ELECTRIC CO.
One River Road
Schenectady 5, N. Y.

Locomotives, Diesel-Hydraulic

THE FATE-ROOT-HEATH COMPANY
Plymouth Locomotive Works
Plymouth, Ohio

Locomotives, Diesel Mechanical

See also headings above.

ABOE, INC.
Empire State Bldg.
New York 16, N. Y.

INTERNATIONAL DIESEL LOCOMOTIVE CORP.
13-02 44th Avenue
Long Island City 1, N. Y.

Locomotives, Diesel Mine

INTERNATIONAL DIESEL LOCOMOTIVE CORP.
13-02 44th Avenue
Long Island City 1, N. Y.

Lubricants

See also "Industrial Oils", "Greases", "Industrial Greases"

D-A LUBRICANT CO., INC.
1311 West 29th Street
Indianapolis, Indiana

GULF OIL CORP.
GULF REFINING CO.
3702 Gulf Bldg.
Pittsburgh 30, Pa.

SINCLAIR REFINING CO.
630 Fifth Ave.
New York 20, N. Y.

THE TEXAS COMPANY
135 E. 42d St.
New York 17, N. Y.

TIDE WATER ASSOCIATED OIL CO.
17 Battery Place
New York 4, N. Y.

Lubricating Compound

CITIES SERVICE OIL CO.
60 Wall Tower
New York 5, N. Y.

Lubricating Oil Compound

VALVOLINE OIL COMPANY
Freedom, Pa.

Lubricating Oils

See also "Diesel Engine Lubricating Oil".

CITIES SERVICE OIL CO.
60 Wall Tower
New York 5, N. Y.

D-A LUBRICANT CO., INC.
1311 West 29th Street
Indianapolis, Indiana

GULF OIL CORP.
GULF REFINING CO.
3702 Gulf Bldg.
Pittsburgh 30, Pa.

MID-CONTINENT PETROLEUM CORP.
Tulsa 2, Okla.

THE PURE OIL CO.
35 East Wacker Drive
Chicago 1, Illinois

SINCLAIR REFINING CO.
630 Fifth Ave.
New York 20, N. Y.

SOCONY-VACUUM OIL CO.
26 Broadway
New York 4, N. Y.

STANDARD OIL CO. OF CALIFORNIA
225 Bush Street
San Francisco, Calif.

STANDARD OIL CO. (INDIANA)
910 South Michigan Ave.
Chicago, Illinois

TIDE WATER ASSOCIATED OIL C[illegible].
17 Battery Place
New York 4, N. Y.

VALVOLINE OIL COMPANY
Freedom, Pa.

VISCOSITY OIL CO.
3820 West Pershing Road
Chicago 32, Illinois

Lubricators, Diesel Traction Motor Suspension Bearing

MILLER-FELPAX CORP.
51 Walnut St.
Winona, Minn.

Lubricators, Felt Wick

MILLER-FELPAX CORP.
51 Walnut St.
Winona, Minn.

Lubricators, Mechanical

MADISON-KIPP CORP.
Madison 10, Wisc.

MANZEL DIV. OF FRONTIER INDUSTRIES, INC.
271 Babcock Street
Buffalo 10, N. Y.

MC CORD CORPORATION
2587 E. Grand Blvd.
Detroit 11, Michigan

Machine Tools

LIMA-HAMILTON CORP.
545 North Third Street
Hamilton, Ohio

Machine Tools, Precision

BROWN & SHARPE MFG. CO.
235 Promenade Street
Providence 8, Rhode Island

Machine Tools, Precision Honing

MICROMATIC HONE CORP.
8100 Schoolcraft
Detroit 4, Michigan

Magnets

AUTOMATIC SWITCH COMPANY
391 Lakeside Ave.
Orange, N. J.

Marine Diesel—Front End Gear Driven Accessories

HARNISCHFEGER CORP.
DIESEL DIVISION
100 Lake Street
Port Washington, Wisconsin

Marine Engines

ENTERPRISE ENGINE & MACH. CO.
18th & Florida Streets
San Francisco 10, Calif.

R. H. SHEPPARD CO.
101 Philadelphia Street
Hanover, Pa.

Marine Reverse & Reduction Gears

STEWART & STEVENSON SERVICES
4516 Harrisburg Blvd.
Houston 11, Texas
TWIN DISC CLUTCH CO.
1328 Racine
Racine, Wisconsin

Metal Spraying & Finishing

BRODIE SYSTEM
115 Clifton Place
Brooklyn 5, N. Y.

Metal Stamping Presses

LIMA-HAMILTON CORP.
545 No. Third St.
Hamilton, Ohio

Meters, Elapsed Time

BURLINGTON INSTRUMENT CO.
203 N. 3rd St.
Burlington, Iowa

Meters, Electrical Indicating

See also "Ammeters"; "Volt-Ammeters, Clamp-On Type".

BURLINGTON INSTRUMENT CO.
203 N. 3rd St.
Burlington, Iowa
WESTON ELECTRICAL INSTRUMENT CORP.
614 Frelinghuysen Ave.
Newark 5, N. J.

Meters, Engine Hour

BURLINGTON INSTRUMENT CO.
203 N. 3rd St.
Burlington, Iowa

Meters, Fuel Oil

NEPTUNE METER CO.
50 West 50th St.
New York 20, N. Y.
ROCKWELL MFG. CO.
PITTSBURGH EQUITABLE METER DIV.
400 N. Lexington Ave.
Pittsburgh 8, Pa.
WORTHINGTON PUMP & MACHINERY CORP.
Harrison, New Jersey

Micrometers

BROWN & SHARPE MFG. CO.
235 Promenade Street
Providence 8, Rhode Island

Motor Fuels

See also "Automotive Diesel Fuel"; "Diesel Fuel Oil"; "Fuel Oil, Diesel"; "Oil, Diesel Fuel".

CITIES SERVICE OIL CO.
60 Wall Tower
New York 5, N. Y.

Motor Generator Sets—Electroplating, Low Voltage

COLUMBIA ELECTRIC MFG. CO.
4519 Hamilton Ave.
Cleveland 14, Ohio

Motors, Electric, A. C. & D. C.

FAIRBANKS, MORSE & CO.
600 S. Michigan Ave.
Chicago 5, Ill.
GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.
RELIANCE ELECTRIC & ENGINEERING CO.
1088 Ivanhoe Road
Cleveland 10, Ohio

Motors, Gear

GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.
LINK-BELT CO.
2045 West Hunting Park Ave.
Philadelphia 40, Pa.
RELIANCE ELECTRIC & ENGINEERING CO.
1088 Ivanhoe Road
Cleveland 10, Ohio

Mufflers, Intake & Exhaust

See also headings under "Silencers".

BURGESS-MANNING CO.
749 East Park Ave.
Libertyville, Ill.
DONALDSON CO., INC.
666 Pelham Blvd.
St. Paul 4, Minn.
THE FLUOR CORP.
403 West Eighth St.
LosAngeles 22, Calif.
MAXIM SILENCER CO.
85 Homestead Ave.
Hartford 5, Conn.

Mufflers, Spark Arresting

MAXIM SILENCER CO.
85 Homestead Ave.
Hartford 5, Conn.

Nozzles, Spray, Water Cooled

AMERICAN BOSCH CORP.
3664 Main Street
Springfield 7, Mass.

Nozzles, Spray, Water Cooling

See also "Spray Nozzles, Water".

BINKS MFG. CO.
3114 Carroll Ave.
Chicago 12, Ill.
THE FLUOR CORP.
403 West Eighth St.
LosAngeles 22, Calif.

Nozzle Testers

BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett St.
Pittsburgh 8, Pa.
KIENE DIESEL ACCESSORIES, INC.
10352 Pacific Ave.
Franklin Park 48, Ill.

Nuts, Lock

COLUMBIA NUT & BOLT CO., INC.
945 Main St.
Bridgeport 3, Conn.
ELASTIC STOP NUT CORP. OF AMERICA
2330 Vauxhall Road
Union, New Jersey

Nuts, Plain and Castle

COLUMBIA NUT & BOLT CO., INC.
945 Main St.
Bridgeport 3, Conn.

Oil Conditioners

See also headings under "Reclaimers"; "Purifiers, "Conditioners", etc.

U. S. HOFFMAN MACHINERY CORP.
FILTRATION DIVN.
219 Lamson St.
Syracuse 6, N. Y.

Oil Coolers, Cleaners

OAKITE PRODUCTS, INC.
22 Thames Street
New York 6, N. Y.

Oil Coolers, Lubricating

See also headings under "Coolers"; and "Heat Exchangers"; "Exchangers, Heat".

HARRISON RADIATOR DIVISION
GENERAL MOTORS CORP.
Washburn Street
Lockport, N. Y.
ROSS HEATER & MFG. CO., INC.
1405 West Avenue
Buffalo 13, N. Y.
STRUTHERS-WELLS CORP.
Warren, Pa.

Oil Filters

See also headings under "Filters".

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio
AMERICAN BOSCH CORP.
3664 Main Street
Springfield 7, Mass.
CUNO ENGINEERING CORP.
80 South Vine Street
Meriden, Conn.
FRAM CORP.
Providence 16, R. I.
HONAN-CRANE CORPORATION
Subsidiary of HOUDAILLE-HERSHEY CORP.
30 Madison Ave.
Lebanon, Indiana
MICHIANA PRODS. CORP.
Michigan City, Indiana
WILLIAM W. NUGENT & CO.
410 N. Hermitage Ave.
Chicago 22, Ill.
PUROLATOR PRODUCTS, INC.
970 New Brunswick Ave.
Rahway, N. J.
U. S. HOFFMAN MACHINERY CORP.
FILTRATION DIVISION
219 Lamson Street
Syracuse 6, N. Y.
WINSLOW ENGINEERING CO.
4069 Hollis Street
Oakland 8, Calif.

Oil Heaters

ROSS HEATER & MFG. CO., INC.
1405 West Avenue
Buffalo 13, N. Y.
STRUTHERS-WELLS CORP.
Warren, Pa.

Oiling Systems, Pressure & Gravity Types

WILLIAM W. NUGENT & CO.
410 N. Hermitage Ave.
Chicago 22, Ill.

Oil Purification Systems, Centrifugal

See also headings under "Centrifugal Purifiers".

THE DE LAVAL SEPARATOR CO.
165 Broadway
New York 6, N. Y.

Oil Purification Systems, Filtering Earth Type

U. S. HOFFMAN MACHINERY CORP.
FILTRATION DIVISION
219 Lamson Street
Syracuse 6, N. Y.

Oil Purification Systems Pressure and Gravity Types

CUNO ENGINEERING CORP.
80 South Vine Street
Meriden, Conn.
WM. W. NUGENT & CO., INC.
410 North Hermitage Ave.
Chicago 22, Illinois
WINSLOW ENGINEERING CO.
4069 Hollis Street
Oakland 8, Calif.

Oil Reclamation Systems

GUSTIN-BACON MFG. CO.
Kansas City 7, Mo.
WILLIAM W. NUGENT & CO.
410 N. Hermitage Ave.
Chicago 22, Ill.
U. S. HOFFMAN MACHINERY CORP.
FILTRATION DIVISION
219 Lamson Street
Syracuse 6, N. Y.

Oil Re-refiners

WALTER KIDDE & CO., INC.
Youngstown Miller Div.
173 Main St.
Belleville 9, New Jersey

Oil Seals & Grease Retainers

THE FITZGERALD MFG. CO.
Torrington, Conn.
VICTOR MFG. & GASKET CO
5750 West Roosevelt Road
Chicago, Illinois

Oil Separators

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio
WORTHINGTON PUMP & MACHINERY CORP.
Harrison, New Jersey

Oil Systems, Pressure and Gravity Type

MADISON KIPP CORP.
Madison, Wisconsin

Oil Testing Equipment (Engine Room Type)

THE GERIN CORP.
P. O. Box 653
Red Bank, N. J.

Oils, Diesel Fuel

See also "Automotive Diesel Fuel"; "Diesel Fuel Oil"; "Fuel Oil, Diesel"; "Motor Fuels".

THE TEXAS COMPANY
135 E. 42d St.
New York 17, N. Y.

Packaged Generators

See also "Diesel Generating Sets"; "Generating Sets Electric"; Auxiliary Diesel Generating Sets"; "Emergency Diesel Generator Systems"; "Emergency Lighting Plants".

BFM INDUSTRIES, INC.
2124-28 Mill Ave.
Brooklyn 34, N. Y.
GENERAL ELECTRIC CO.
One River Road
Schenectady 5, N. Y.
R. H. SHEPPARD CO.
101 Philadelphia St.
Hanover, Pa.
WORTHINGTON PUMP & MACHINERY CORP.
Harrison, New Jersey

Packing, Oil Wiper

C. LEE COOK MFG. CO.
76 Beaver Street
New York, N. Y.
DOUBLE SEAL RING CO.
2065 Montgomery St.
Fort Worth, Texas

Packing, Rod Metallic

C. LEE COOK MFG. CO.
76 Beaver St.
New York, N. Y.
DOUBLE SEAL RING CO.
2065 Montgomery St.
Fort Worth, Texas

Packing, Sheet

VICTOR MFG. & GASKET CO.
5750 W. Roosevelt Road
Chicago, Ill.

Packing Sheets, Oil & Water

THE FITZGERALD MFG. CO.
Torrington, Conn.

Pillow Blocks, Anti-Friction

SKF INDUSTRIES, INC.
Front St. & Erie Ave.
P.O. Box 6731
Philadelphia 32, Pa.

Pillow Blocks, Babbitted and Bronze-Bushed-Bearings

LINK-BELT CO.
2410 West 18th St.
Chicago P, Ill.

Pillow Blocks, Ball & Roller Bearing

LINK-BELT CO.
519 N. Holmes Ave.
Indianapolis 6, Ind.

Pins, Roll Pins

ELASTIC STOP NUT CORP. OF AMERICA
2330 Vauxhall Road
Union, New Jersey

Pipe Fittings, Compression

WM. W. NUGENT & CO.
410 N. Hermitage Ave.
Chicago 22, Ill.

Piston Pin Bearings

See also "Bearings, Piston Pin".

THE CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Ave.
Cleveland 10, Ohio

Piston Pins

BURGESS-NORTON MFG. CO.
Geneva, Ill.
SEALED POWER CORP.
Muskegon 61, Michigan

Piston Ring Pot Castings

CENTRIFUGAL FOUNDRY CO.
Muskegon, Michigan

Piston Ring Removers

DOUBLE SEAL RING CO.
2065 Montgomery St.
Fort Worth, Texas

Piston Rings

C. LEE COOK MFG. CO.
76 Beaver St.
New York, N. Y.
DOUBLE SEAL RING CO.
2065 Montgomery St.
Fort Worth, Texas
KOPPERS CO., INC.
Metal Products Div.
Bush and Hamburg Sts.
P.O.B. 626
Baltimore 3, Md.
MUSKEGON PISTON RING CO.
Sixth & Alpha Sts.
Muskegon, Michigan
PERFECT CIRCLE
DIVN. OF THOMPSON PRODUCTS, INC.
Hagerstown, Indiana
SEALED POWER CORP.
Muskegon 61, Michigan
WAUSAU MOTOR PARTS CO.
1005 Harrison Blvd.
Wausau, Wisconsin
WILKENING MFG. CO.
2000 S. 71st St.
Philadelphia 42, Pa.

Piston Rings, Oil Control

C. LEE COOK MFG. CO.
76 Beaver Street
New York, N. Y.
KOPPERS COMPANY, INC.
METAL PRODUCTS DIVISION
Bush and Hamburg Sts.
P. O. Box 626
Baltimore 3, Maryland

Piston Rings, Sealing

C. LEE COOK MFG. CO.
76 Beaver St.
New York, N. Y.
DOUBLE SEAL RING CO.
2065 Montgomery St.
Fort Worth, Texas
KOPPERS COMPANY, INC.
METAL PRODUCTS DIVISION
Bush and Hamburg Sts.
P. O. Box 626
Baltimore 3, Maryland
WILKENING MFG. CO.
2000 S. 71st St.
Philadelphia 42, Pa.

Pistons

CAMPBELL, WYANT & CANNON FOUNDRY CO.
Muskegon 83, Michigan

Pistons, Aluminum Alloy

SEALED POWER CORP.
Muskegon 61, Michigan

Pistons, Aluminum Alloy, Repaired

RALPH STARK, INC.
43-12 33rd St.
Long Island City, N. Y.

Pistons, Material for Cleaning

OAKITE PRODUCTS, INC.
22 Thames St.
New York 6, N. Y.

Planimeter, Indicator Card

BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett St.
Pittsburgh 8, Pa.

Plating, Porous Chrome

SPAR-TAN ENGINEERING CO.
Western Licensee—Van der Horst Corp.
2445 Enterprise St.
Los Angeles 21, Calif.
VAN DER HORST CORP. OF AMERICA
Olean, New York

Portable Contractors' Power Units

See also "Diesel Power Units" and other headings this page.

FAIRBANKS, MORSE & CO.
600 S. Michigan Ave.
Chicago 5, Ill.
HARNISCHFEGER CORP.
Diesel Division
100 Lake St.
Port Washington, Wisconsin
JOHN REINER & CO.
12-12 37th Ave.
Long Island City 1, N. Y.
WAUKESHA MOTOR CO.
P.O. Box 379
Waukesha, Wisconsin

Portable Power Units

BFM INDUSTRIES, INC.
2124-28 Mill Avenue
Brooklyn 34, N. Y.

Power Plants, Automatically Controlled

STEWART & STEVENSON SERVICES
4516 Harrisburg Blvd.
Houston 11, Texas
WAUKESHA MOTOR CO.
P.O. Box 379
Waukesha, Wisconsin

Power Take-Off Units

FAWICK AIRFLEX CO., INC.
9919 Clinton Road
Cleveland 11, Ohio
ROCKFORD CLUTCH DIV.
BORG-WARNER CORP.
1301 18th Ave.
Rockford, Ill.
TWIN DISC CLUTCH CO.
1328 Racine
Racine, Wisconsin

Power Units

See also "Diesel Power Units" and other headings this page.

ABOE, INC.
Empire State Bldg.
New York 16, N. Y.

FAIRBANKS, MORSE & CO.
600 S. Michigan Ave.
Chicago 5, Ill.

R. H. SHEPPARD CO.
101 Philadelphia St.
Hanover, Penna.

STEWART & STEVENSON SERVICES
4516 Harrisburg Blvd.
Houston 11, Texas

WAUKESHA MOTOR CO.
P.O. Box 379
Waukesha, Wisconsin

Power Units, Diesel

See also "Diesel Power Units" and other headings this page.

HERCULES MOTORS CORP.
Canton 2, Ohio

Presses, Electric, Hydraulic Air Operated

LEMPCO PRODUCTS, INC.
5490 Dunham Rd.
Bedford, Ohio

Pressuregraph

ELECTRO PRODUCTS LABORATORIES, INC.
4501 N. Ravenswood
Chicago 40, Illinois

Pressure Switches

UNITED ELECTRIC CONTROLS CO.
85 School St.
Watertown 72, Mass.

Pulsation Dampeners

THE FLUOR CORP.
403 W. Eighth St.
Los Angeles 22, Calif.

Pumping Units

See also "Diesel Pumping Units" and below

BFM INDUSTRIES, INC.
2124-28 Mill Avenue
Brooklyn 34, N. Y.

Pumping Units, Diesel

See also "Diesel Pumping Units" and above.

ABOE, INC.
Empire State Bldg.
New York 16, N. Y.

GRIFFIN EQUIPMENT CORP.
880 E. 141st St.
New York 54, N. Y.

INGERSOLL-RAND CO.
11 Broadway
New York 4, N. Y.

Pumps, Automatic Reversing

BROWN & SHARPE MFG. CO.
235 Promenade St.
Providence 8, R. I.

TUTHILL PUMP CO.
939 E. 95th St.
Chicago 19, Ill.

VIKING PUMP CO.
Cedar Falls, Iowa

Pumps, Centrifugal

BROWN & SHARPE MFG. CO.
235 Promenade St.
Providence 8, R. I.

DE LAVAL STEAM TURBINE CO.
Trenton 2, New Jersey

INGERSOLL RAND CO.
11 Broadway
New York 4, N. Y.

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, N. J.

Pumps, Cooling Water

BROWN & SHARPE MFG. CO.
235 Promenade St.
Providence 8, R. I.

DE LAVAL STEAM TURBINE CO.
Trenton 2, N. J.

INGERSOLL-RAND CO.
11 Broadway
New York 4, N. Y.

SCHWITZER-CUMMINS CO.
1125 Massachusetts Ave.
Indianapolis, Ind.

VIKING PUMP CO.
Cedar Falls, Iowa

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, New Jersey

Pumps, Fuel Oil Injection

AMERICAN BOSCH CORP.
3664 Main Street
Springfield 7, Mass.

C. A. V. LIMITED
Acton, London, W. 3, England

DIESEL ENGINEERING & MFG. CORP.
200 N. Laflin St.
Chicago 7, Illinois

SCINTILLA MAGNETO DIV.
BENDIX AVIATION CORP.
Sidney, N. Y.

Pumps, Fuel Transfer

AMERICAN BOSCH CORP.
3664 Main St.
Springfield 7, Mass.

JOHN S. BARNES CORP.
301 S. Water St.
Rockford, Illinois

BROWN & SHARPE MFG. CO.
235 Promenade St.
Providence 8, R. I.

DE LAVAL STEAM TURBINE CO.
Trenton 2, New Jersey

HANCOCK MACHINE CO.
300 Walnut St.
Findlay, Ohio

INTERSTATE DIESEL SERVICE, INC.
5103 Detroit Ave.
Cleveland 2, Ohio

GEO. D. ROPER CORP.
340 Blackhawk Park Ave.
Rockford, Ill.

TUTHILL PUMP CO.
939 E. 95th St.
Chicago 19, Ill.

VIKING PUMP CO.
Cedar Falls, Iowa

Pumps, Hydraulic

JOHN S. BARNES CORP.
301 S. Water St.
Rockford, Illinois

VIKING PUMP CO.
Cedar Falls, Iowa

Pumps, Hydraulic Controls

BROWN & SHARPE MFG. CO.
235 Promenade St.
Providence, R. I.

DE LAVAL STEAM TURBINE CO.
Trenton 2, New Jersey

TUTHILL PUMP CO.
939 East 95th St.
Chicago 19, Ill.

Pumps, Lubricating Oil

BROWN & SHARPE MFG. CO.
235 Promenade St.
Providence 8, R. I.

DE LAVAL STEAM TURBINE CO.
Trenton 2, New Jersey

MADISON KIPP CORP.
Madison, Wisconsin

WM. W. NUGENT & CO.
410 N. Hermitage Ave.
Chicago 22, Ill.

GEO. D. ROPER CORP.
340 Blackhawk Park Ave.
Rockford, Ill.

TUTHILL PUMP CO
939 E. 95th St.
Chicago 19, Ill.

VIKING PUMP CO.
Cedar Falls, Iowa

Pumps, Oil

DE LAVAL STEAM TURBINE CO.
Trenton 2, New Jersey

GEO. D. ROPER CORP.
340 Blackhawk Park Ave.
Rockford, Ill.

SCHWITZER-CUMMINS CO.
1125 Massachusetts Ave.
Indianapolis 7, Indiana

TUTHILL PUMP CO.
939 East 95th St.
Chicago 19, Ill.

VIKING PUMP CO.
Cedar Falls, Iowa

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, New Jersey

Pumps, Rotary Gear Type

JOHN S. BARNES CORP.
301 S. Water St.
Rockford, Illinois

BROWN & SHARPE MFG. CO.
235 Promenade St.
Providence 8, R. I.

GEO. D. ROPER CORP.
340 Blackhawk Park Ave.
Rockford, Ill.

TUTHILL PUMP CO.
939 E. 95th St.
Chicago 19, Ill.

VIKING PUMP CO.
Cedar Falls, Iowa

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, New Jersey

Pumps, Rotary, Screw Type

DE LAVAL STEAM TURBINE CO.
Trenton 2, New Jersey

Pumps, Stripped Models

BROWN & SHARPE MFG. CO.
235 Promenade St.
Providence 8, R. I.

TUTHILL PUMP CO.
939 E. 95th St.
Chicago 19, Ill.

VIKING PUMP CO.
Cedar Falls, Iowa

Pumps, Vacuum

ROOTS-CONNERSVILLE BLOWER CORP.
Connersville, Ind.

Purifiers, Fuel Oil

See also "Conditioners, Fuel & Lube Oil"; "Reclaimers, Oil"; and headings under "Oil".

FRAM CORP.
Providence 16, R. I.

THE HILLIARD CORP.
120 West 4th St.
Elmira, N. Y.

WILLIAM W. NUGENT & CO.
410 N. Hermitage Ave.
Chicago 22, Ill.

Purifiers, Industrial Oil

WM. W. NUGENT & CO.
410 N. Hermitage Ave.
Chicago 22, Ill.

Purifiers, Lubricating Oil

See also "Conditioners, Fuel & Lube Oil"; "Reclaimers, Oil"; and headings under "Oil".

FRAM CORP.
Providence 16, R. I.

GUSTIN-BACON MFG. CO.
Kansas City 7, Mo.

THE HILLIARD CORP.
120 West 4th Street
Elmira, N. Y.

WM. W. NUGENT & CO.
410 N. Hermitage Ave.
Chicago 22, Ill.

Purifiers, Oil

See heading above.

CUNO ENGINEERING CORP.
80 South Vine St.
Meriden, Conn.

THE DE LAVAL SEPARATOR CO.
165 Broadway
New York 6, N. Y.

FRAM CORP.
Providence 16, R. I.

THE HILLIARD CORP.
120 West 4th St.
Elmira, N. Y.

WILLIAM W. NUGENT & CO.
410 N. Hermitage Ave.
Chicago 22, Ill.

Push Rods

THE CHICAGO SCREW CO.
2701 Washington Blvd.
Bellwood, Ill.

Pyrometers, Exhaust

ILLINOIS TESTING LABORATORIES, INC.
420 N. LaSalle St.
Chicago 10, Ill.

Pyrometers, Portable

ILLINOIS TESTING LABORATORIES, INC.
420 N. LaSalle St.
Chicago 10, Ill.

Radiator Cooling System Treatment

SOCONY-VACUUM OIL CO.
26 Broadway
New York 4, N. Y.

YOUNG RADIATOR CO.
Racine, Wisconsin

Radiators, Engine Cooling

HARRISON RADIATOR DIV.
GENERAL MOTORS CORP.
Washburn Street
Lockport, N. Y.

ROME TURNEY RADIATOR CO.
Box 32
Rome, New York

YATES-AMERICAN MACHINE CO.
Beloit, Wisconsin

YOUNG RADIATOR CO.
Racine, Wis.

Rail Car Engines

ABOE, INC.
Empire State Bldg.
New York 16, N. Y.

R. H. SHEPPARD CO.
101 Philadelphia St.
Hanover, Pa.

Reamers

LEMPCO PRODUCTS, INC.
5490 Dunham Rd.
Bedford, Ohio

Reclaimers, Oil

See also "Conditioners, Fuel & Lube Oil"; headings under "Purifiers" and "Oil".

GUSTIN-BACON MFG. CO.
Kansas City 7, Mo.

THE HILLIARD CORP.
120 West 4th St.
Elmira, N. Y.

WILLIAM W. NUGENT & CO.
410 N. Hermitage Ave.
Chicago 22, Ill.

Reducing Motions, Engine Indicating

BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett St.
Pittsburgh 8, Pa.

Regulators, Current & Voltage

See also headings under "Voltage".

AMERICAN BOSCH CORP.
3664 Main St.
Springfield, Mass.

DELCO-REMY DIV.
GENERAL MOTORS CORP.
Anderson, Ind.

GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.

THE LEECE-NEVILLE CO.
5109 Hamilton Ave.
Cleveland 14, Ohio

Regulators, Generator Voltage

BURLINGTON INSTRUMENT CO.
203 North 3rd St.
Burlington, Iowa

Regulators, Temperature

THE POWERS REGULATOR CO.
2710 Greenview Ave.
Chicago 14, Ill.

Relays

AUTOMATIC SWITCH CO.
391 Lakeside Ave.
Orange, N. J.

DELCO-REMY DIV.
GENERAL MOTORS CORP.
Anderson, Ind.

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

WESTON ELECTRICAL INSTRUMENT CORP.
614 Frelinghuysen Ave.
Newark 5, N. J.

Repairs, Diesel

BRODIE SYSTEM
115 Clifton Place
Brooklyn 5, N. Y.

GRIFFIN EQUIPMENT CORP.
880 E. 141 St.
New York 54, N. Y.

STEWART & STEVENSON SERVICES
4516 Harrisburg Blvd.
Houston 11, Texas

Reversing Switches

COLUMBIA ELECTRIC MFG. CO.
4519 Hamilton Ave.
Cleveland 14, Ohio

Rheostats, Plating Tank Type

COLUMBIA ELECTRIC MFG. CO.
4519 Hamilton Ave.
Cleveland 14, Ohio

Roller Bearings

SKF INDUSTRIES, INC.
Front St. & Erie Ave.
P. O. Box 6731
Phila. 32, Pa.

Rotorseals, Quick Release Valves, etc.

FAWICK AIRFLEX CO. INC
9919 Clinton Road
Cleveland 11, Ohio

Rotary Pumps

DE LAVAL STEAM TURBINE CO.
Trenton 2, N. J.

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, N. J.

Rust Preventatives

See also "Anti-Rust Compounds"

GULF OIL CORP.

GULF REFINING CO.
3702 Gulf Bldg.
Pittsburgh 30, Pa.

OAKITE PRODUCTS, INC.
22 Thames St.
New York 6, N. Y.

SOCONY-VACUUM OIL CO.
26 Broadway
New York 4, N. Y.

THE TEXAS COMPANY
135 E. 42nd St.
New York 17, N. Y.

VALVOLINE OIL CO.
Freedom, Pa.

YOUNG RADIATOR CO.
Racine, Wisconsin

Rust Removers

OAKITE PRODUCTS, INC.
22 Thames St.
New York 6, N. Y.

VALVOLINE OIL CO.
Freedom, Pa.

Safety Controls, Engine

PENN ELECTRIC SWITCH CO.
Goshen, Indiana

SYNCHRO START PRODS., INC.
8151 N. Ridgeway Ave.
Skokie, Ill.

Scale Removal

OAKITE PRODUCTS, INC.
22 Thames Street
New York 6, N. Y.

Scavenging Air Blowers & Compressors

See also headings under "Blowers", "Supercharging Blowers", "Turbochargers and Superchargers".

PESCO-PRODUCTS DIVN.
BORG-WARNER CORP.
11610 Euclid Ave.
Cleveland 6, Ohio

Schools, Diesel Mechanics

HEMPHILL DIESEL SCHOOLS
31-28 Queens Blvd.
Long Island City, N. Y.

Screw Machine Products

THE CHICAGO SCREW COMPANY
2701 Washington Boulevard
Bellwood, Illinois

COLUMBIA NUT & BOLT CO., INC.
945 Main St.
Bridgeport 3, Conn.

Screw Machine Products Hardened & Ground

BURGESS-NORTON MFG. CO.
Geneva, Ill.

Scuffing Rings, Allan Red Metal, Copper-Lead Segment Form

A. ALLAN & SON
603 Bergen St.
Harrison, N. J.

Sealed Beam Units

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Sealing Rings

C. LEE COOK MFG. CO.
76 Beaver St.
New York, N. Y.
KOPPERS CO., INC.
Metal Products Div.
Bush and Hamburg Sts.
P. O. B. 626
Baltimore 3, Md.

Seals, Automatic Shaft

SCHWITZER-CUMMINS CO.
1125 Massachusetts Ave.
Indianapolis 7, Ind.

Self Retaining Nuts

COLUMBIA NUT & BOLT CO., INC.
945 Main St.
Bridgeport 3, Conn.
ELASTIC STOP NUT CORP. OF AMERICA
2330 Vauxhall Road
Union, New Jersey

Shafts, Hardened & Ground

NATIONAL FORGE & ORDNANCE CO.
Irvine, Warren Co., Pa.

Signal Systems—Signals Alarm, For Liquid Level, Pressure and Temperature

ROCHESTER MFG. CO., INC.
100 Rockwood Street
Rochester 10, N. Y.

Silencers, Air Filter, Intake

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio
AMERICAN AIR FILTER CO., INC.
445 Central Ave.
Louisville 8, Ky.
BURGESS-MANNING CO.
749 East Park Ave.
Libertyville, Ill.

Silencers, Exhaust

See also headings under "Mufflers".
BURGESS-MANNING CO.
749 East Park Ave.
Libertyville, Ill.
THE FLUOR CORP.
403 W. Eighth St.
Los Angeles 22, Calif.
MAXIM SILENCER CO.
85 Homestead Ave.
Hartford 5, Conn.

Silencers, Intake

See heading above.
BURGESS-MANNING CO.
749 East Park Ave.
Libertyville, Ill.
THE FLUOR CORP.
403 W. Eighth St.
Los Angeles 22, Calif.
MAXIM SILENCER CO.
85 Homestead Ave.
Hartford 5, Conn.

Solvents

CITIES SERVICE OIL CO.
60 Wall Tower
New York 5, N. Y.

Solvents, Degreasing

OAKITE PRODUCTS, INC.
22 Thames St.
New York 6, N. Y.
SOCONY-VACUUM OIL CO.
26 Broadway
New York 4, N. Y.

Solvents for Petroleum Residues

OAKITE PRODUCTS, INC.
22 Thames Street
New York 6, N. Y.
SOCONY-VACUUM OIL CO.
26 Broadway
New York 4, N. Y.

Spark Arrestors

AIR-MAZE CORP.
5200 Harvard Ave.
Cleveland 5, Ohio
BURGESS-MANNING CO.
749 East Park Ave.
Libertyville, Ill.
MAXIM SILENCER CO.
85 Homestead Ave.
Hartford 5, Conn.

Spark Ignition, Oil Engines

WAUKESHA MOTOR CO.
P. O. Box 379
Waukesha, Wisconsin

Spark Plugs

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Spark Plugs, Diesel Starting

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Special Alloy Steel Cylinder & Main Bearing Studs

See also "Bolts"; "Engine Bolts, Studs & Nuts"; "Alloy Steel Bolts & Nuts"; "Connecting Rod Bolts & Nuts".
THE CHICAGO SCREW COMPANY
2701 Washington Boulevard
Bellwood, Illinois

Speedometers

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Speed Reducers and Increasers

DE LAVAL STEAM TURBINE CO.
Trenton 2, N. J.
LINK-BELT CO.
2045 West Hunting Park Ave.
Philadelphia 40, Pa.
WORTHINGTON PUMP & MACHINERY CORP.
Harrison, New Jersey

Spray Nozzles, Fuel Injection

AMERICAN BOSCH CORP.
3664 Main St.
Springfield 7, Mass.
SCINTILLA MAGNETO DIV.
BENDIX AVIATION CORP.
Sidney, N. Y.

Spray Nozzles, Fuel Injection Water Cooled

SCINTILLA MAGNETO DIVN.
BENDIX AVIATION CORP.
Sidney, N. Y.

Spray Nozzles, Oil

BINKS MFG. CO.
3114 Carroll Ave.
Chicago 12, Ill.

Spray Nozzles, Water

See also "Nozzles, Spray, Water Cooling".
LINK-BELT CO.
300 W. Pershing Road
Chicago 9, Illinois
THE MARLEY CO., INC.
Fairfax and Marley Roads
Kansas City 15, Kansas
J. F. PRITCHARD & CO.
908 Grand Ave.
Kansas City, Mo.

Spray Ponds

BINKS MFG. CO.
3114 Carroll Ave.
Chicago 12, Ill.
THE MARLEY CO., INC.
Fairfax and Marley Roads
Kansas City 15, Kansas

Spray Towers

See also "Cooling Towers"; "Towers, Cooling".
BINKS MFG. CO.
3114 Carroll Ave.
Chicago 12, Ill.
THE FLUOR CORP.
403 W. Eighth St.
Los Angeles 22, Calif.
J. F. PRITCHARD & CO.
908 Grand Ave.
Kansas City 6, Mo.

Sprockets

LINK-BELT CO.
220 S. Belmont Ave.
Indianapolis 6, Ind.

Stampings, Metal

BURGESS-NORTON MFG. CO.
Geneva, Ill.

Starting Batteries, Storage

See also headings under "Batteries".
BFM INDUSTRIES, INC.
2124-28 Mill Ave.
Brooklyn 34, N. Y.
ELECTRIC STORAGE BATTERY CO.
19th St. & Allegheny Ave.
Philadelphia 32, Pa.

Starting Motors, Electric

DELCO-REMY DIV.
GENERAL MOTORS CORP.
Anderson, Indiana
THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Starting Motors, Electric, Air

THE LEECE-NEVILLE CO.
5109 Hamilton Ave.
Cleveland 14, Ohio

Starting Units, Engine Driven Air Compressor

INGERSOLL-RAND CO.
11 Broadway
New York 4, N. Y.
QUINCY COMPRESSOR CO.
217 Main St.
Quincy, Ill.

Starting Units, Motor-Driven

INGERSOLL-RAND CO.
11 Broadway
New York 4, N. Y.
QUINCY COMPRESSOR CO.
217 Main St.
Quincy, Ill.

Stationary Diesel Engines

ENTERPRISE ENGINE & MACH. CO.
18th & Florida Sts.
San Francisco 10, Calif.

Steam Cleaning Equipment

OAKITE PRODUCTS, INC.
22 Thames St.
New York 6, N. Y.

Steel Tubing, Fuel Injection

SUMMERILL TUBING CO. DIVN.
P. O. Box 1557
Pittsburgh 30, Pa.

Strainers, Oil

CUNO ENGINEERING CORP.
80 South Vine St.
Meriden, Conn.
WILLIAM W. NUGENT & CO.
410 N. Hermitage Ave.
Chicago 22, Ill.

Strainers, Water
CUNO ENGINEERING CORP.
80 South Vine St.
Meriden, Conn.

Supercharger Intercoolers
HARRISON RADIATOR DIVISION
GENERAL MOTORS CORP.
Washburn Street
Lockport, N. Y.
YOUNG RADIATOR CO.
Racine, Wis.

Supercharging Blowers
See also "Blowers, Scavenging and Supercharging", "Scavenging Blowers & Compressors", "Turbochargers, Superchargers".
PESCO PRODUCTS DIVN.
BORG-WARNER CORP.
11610 Euclid Ave.
Cleveland 6, Ohio
SCHWITZER-CUMMINS CO.
1125 Massachusetts Ave.
Indianapolis 7, Ind.

Switchboards and Instruments
CONSOLIDATED DIESEL ELECTRIC CORP.
230 E. 8th St.
Mt. Vernon, N. Y.
GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.
INTERNATIONAL DIESEL ELECTRIC CO., INC.
13-02 44th Avenue
Long Island City 1, N. Y.
STEWART & STEVENSON SERVICES
4516 Harrisburg Blvd.
Houston 11, Texas

Switches, Hydraulic
THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Switches, Manual
THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Switches, Manual Starting
THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Switches, Push Button
DELCO-REMY DIV.
GENERAL MOTORS CORP.
Anderson, Indiana

Switches, Solenoid
DELCO-REMY DIV.
GENERAL MOTORS CORP.
Anderson, Indiana
THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Switches, Solenoid, Push-Button, Foot
THE LEECE-NEVILLE CO.
5109 Hamilton Ave.
Cleveland 14, Ohio

Switches, Starting
DELCO-REMY DIV.
GENERAL MOTORS CORP.
Anderson, Indiana

Switchgear
ELECTRIC MACHINERY & MFG. CO
1331 Tyler St., N.E.
Minneapolis 13, Minn.
GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.
WORTHINGTON PUMP & MACHINERY CORP.
Harrison, N. J.

Synchronizers, Automatic
BURLINGTON INSTRUMENT CO.
203 N. 3d St.
Burlington, Iowa

Systems, Fuel Injection
See also "Injection Systems, Fuel".
BFM INDUSTRIES INC.
2124-28 Mill Avenue
Brooklyn 34, N. Y.

Tachometer Indicators
WESTON ELECTRICAL INSTRUMENT CORP.
614 Frelinghuysen Ave.
Newark 5, N. J.

Tachometers (Centrifugal)
BARBOUR STOCKWELL CO.
205 Broadway
Cambridge 39, Mass.
HERMAN H. STICHT CO., INC.
27 Park Place
New York 7, N. Y.

Tachometers, Centrifugal and Resonant Reed
JAMES G. BIDDLE CO.
1316 Arch St.
Philadelphia 7, Pa.

Tachometers For Diesel Engines
BARBOUR STOCKWELL CO.
205 Broadway
Cambridge 39, Mass.
HERMAN H. STICHT CO., INC.
27 Park Place
New York 7, N. Y.

Tachometers, Electrical
GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.
WESTON ELECTRICAL INSTRUMENT CORP.
614 Frelinghuysen Ave.
Newark 5, N. J.

Tachometers, Hand
BARBOUR STOCKWELL CO.
205 Broadway
Cambridge 39, Mass.
HERMAN H. STICHT CO., INC.
27 Park Place
New York 7, N. Y.

Tachometers, Mechanical
BARBOUR STOCKWELL CO.
205 Broadway
Cambridge 39, Mass.
HERMAN H. STICHT CO., INC.
27 Park Place
New York 7, N. Y.

Tanks
SHARPSVILLE STEEL FABRICATORS, INC.
Sharpsville, Pa.

Tanks, All Kinds
SHARPSVILLE STEEL FABRICATORS, INC.
Sharpsville, Pa.

Tanks, A.S.M.E. Specifications
SHARPSVILLE STEEL FABRICATORS, INC.
Sharpsville, Pa.

Tanks, Compressed Air
SHARPSVILLE STEEL FABRICATORS, INC.
Sharpsville, Pa.

Tanks, Day
SHARPSVILLE STEEL FABRICATORS, INC.
Sharpsville, Pa.

Tanks, Fuel Oil
SHARPSVILLE STEEL FABRICATORS, INC.
Sharpsville, Pa.

Tanks, Truck (for Gasoline & Oil Industry)
SHARPSVILLE STEEL FABRICATORS, INC.
Sharpsville, Pa.

Temperature Recorders
BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett St.
Pittsburgh 8, Pa.

Temperature Regulators, Cooling Water
AMERICAN MOTORS CO.
21 Nevin Ave.
Richmond, Calif.
THE POWERS REGULATOR CO.
2710 Greenview Ave.
Chicago 14, Ill.
UNITED ELECTRIC CONTROLS CO.
85 School St.
Watertown 72, Mass.

Test Equipment
WESTON ELECTRICAL INSTRUMENT CORP.
614 Frelinghuysen Ave.
Newark 5, N. J.

Testers, Battery
ELECTRIC STORAGE BATTERY CO.
19th St. & Allegheny Ave.
Philadelphia 32, Pa.

Testing Instruments, Electrical
JAMES G. BIDDLE CO.
1316 Arch St.
Philadelphia 7, Pa.
ELECTRO PRODUCTS LABORATORIES, INC.
4501 N. Ravenswood Ave.
Chicago 40, Ill.
GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.

Testing Instruments, Oil, Engine Room
THE GERIN CORP.
P. O. Box 653
Red Bank, New Jersey

Thermocouples
GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.
ILLINOIS TESTING LABORATORIES, INC.
420 N. LaSalle St.
Chicago 10, Ill.

Thermometers
BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett Street
Pittsburgh 8, Pa.
ILLINOIS TESTING LABORATORIES, INC.
420 N. LaSalle St.
Chicago 10, Ill.

Thermometers, Dial Indicating
BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett Street
Pittsburgh 8, Pa.
THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio
WESTON ELECTRICAL INSTRUMENT CORP.
614 Frelinghuysen Ave.
Newark 5, N. J.

Thermometers, Dial Indicating, Distance Type
THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio
THE POWERS REGULATOR CO.
2710 Greenview Ave.
Chicago 14, Ill.

Thermometers, Flue Gas
BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett Street
Pittsburgh 8, Pa.

Thermometers, Indicating
THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Thermometers, Portable Recording

BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett Street
Pittsburgh 8, Pa.

Thermometers, Recording

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Timing Chains

LINK-BELT CO.
220 S. Belmont Ave.
Indianapolis 6, Ind.

Tools, Mechanic's Hand

BROWN & SHARPE MFG. CO.
235 Promenade St.
Providence 8, R. I.
SNAP-ON TOOLS CORP.
8064 — 28th Ave.
Kenosha, Wis.

Tools, Special Service

KENT-MOORE ORGANIZATION, INC.
5-105 General Motors Bldg.
Detroit 2, Michigan

Towers, Cooling

See also "Cooling Towers"; "Spray Towers".

THE FLUOR CORP.
403 W. Eighth St.
Los Angeles 22, Calif.
LILIE-HOFFMANN COOLING TOWERS, INC.
4239 Duncan
St. Louis 10, Mo.

Truck Diesels

STEWART & STEVENSON SERVICES
4516 Harrisburg Blvd.
Houston 11, Texas

Tubing, Corrugated, Flexible Metallic

See also headings under "Flexible" and Hose".

THE AMERICAN BRASS CO.
AMERICAN METAL HOSE BRANCH
Waterbury 20, Conn.
PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.
7217 Powers Lane
Philadelphia 42, Pa.
TITEFLEX, INC.
515 Frelinghuysen Ave.
Newark, N. J.
ZALLEA BROS.
Taylor & Locust Sts.
Wilmington, Del.

Tubing, Flexible Metallic

See heading above.

ALLIED METAL HOSE CO.
37-46 9th Street
Long Island City 1, N. Y.
THE AMERICAN BRASS CO.
AMERICAN METAL HOSE BRANCH
Waterbury 20, Conn.
CHICAGO METAL HOSE CORP.
1315 So. 3d Ave.
Maywood, Illinois
PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.
7217 Powers Lane
Philadelphia 42, Pa.
TITEFLEX, INC.
515 Frelinghuysen Ave.
Newark 5, N. J.

Tubing, Flexible, Non-Metallic

RESISTOFLEX CORPORATION
Belleville 9, New Jersey

Tubing, High Pressure

SUMMERILL TUBING COMPANY DIV.
P. O. Box 1557
Pittsburgh 30, Penna.
TITEFLEX, INC.
515 Frelinghuysen Ave.
Newark 5, N. J.

Turbochargers, Superchargers

See also headings under "Blowers"; "Supercharging Blowers"; "Scavenging Air Blowers".

DR. ALFRED J. BUCHI
Engineering Office
Winterthur, Switzerland
U. S. Office, 520 Munsey Bldg.
Washington 4, D. C.

Unit Injectors, Fuel Injection

HANCOCK MACHINE CO.
300 Walnut St.
Findlay, Ohio
SCINTILLA MAGNETO DIV.
BENDIX AVIATION CORP.
Sidney, New York
STEWART & STEVENSON SERVICES
4516 Harrisburg Blvd.
Houston 11, Texas

Valve Adjusters, Hydraulic

EATON MFG. CO.
9771 French Road
Detroit 13, Mich.

Valve Guides

MICHIGAN ENGINE VALVE CO.
437 W. Columbia St.
Detroit 1, Michigan

Valve Plates & Discs of All Types & Sizes

J. H. H. VOSS CO.
785 East 144th St.
New York 54, N. Y.

Valve Refacers

LEMPCO PRODUCTS, INC.
5490 Dunham Rd.
Bedford, Ohio
WATERBURY TOOL DIV.
VICKERS, INC.
Waterbury 20, Conn.

Valve Seat Grinders, Eccentric

WATERBURY TOOL DIV.
VICKERS, INC.
Waterbury 20, Conn.

Valve Seat Inserts

EATON MFG. CO.
9771 French Rd.
Detroit 13, Mich.
MICHIGAN ENGINE VALVE CO.
437 W. Columbia St.
Detroit 1, Michigan
WAUSAU MOTOR PARTS COMPANY
1005 Harrison Boulevard
Wausau, Wisconsin

Valve Tappets

EATON MANUFACTURING CO.
9771 French Road
Detroit 13, Mich.

Valve Tappets, Hydraulic & Mechanical

THE CHICAGO SCREW COMPANY
2701 Washington Boulevard
Bellwood, Illinois

Valves, Air, Ammonia & Gas Compressors

J. H. H. VOSS CO.
785 East 144th St.
New York 54, N. Y.

Valves, Engine Indicator

BACHARACH INDUSTRIAL INSTRUMENT CO.
7000 Bennett Street
Pittsburgh 8, Pa.
KIENE DIESEL ACCESSORIES, INC.
10352 Pacific Ave.
Franklin Park, Ill.

Valves, Poppet (exhaust and inlet)

EATON MFG. CO.
9771 French Road
Detroit 13, Mich.
MICHIGAN ENGINE VALVE CO.
437 W. Columbia St.
Detroit 1, Michigan

Valves, Sight Feed

WILLIAM W. NUGENT & CO.
410 No. Hermitage Avenue
Chicago 22, Ill.

Valves, Solenoid Operated

AUTOMATIC SWITCH COMPANY
391 Lakeside Ave.
Orange, N. J.
PENN ELECTRIC SWITCH CO.
Goshen, Indiana

Valves, Thermostatic

AMERICAN MOTORS CO.
21 Nevin Ave.
Richmond, Calif.
THE POWERS REGULATOR CO.
2710 Greenview Ave.
Chicago 14, Ill.

"Vapor Phase" Cooling System

ENGINEERING CONTROLS CO.
2835 E. 11th St.
Los Angeles 23, Calif.

Variable Speed Drives

LINK-BELT CO.
2045 West Hunting Park Ave.
Philadelphia 40, Pa.

Variable Speed Transmissions

WORTHINGTON PUMP & MACHINERY CORP.
Harrison, New Jersey

Vibration Control

THE KORFUND CO., INC.
48-20-A Thirty-second Place
Long Island City 1, N. Y.

Vibration Eliminators

CHICAGO METAL HOSE CORP.
1315 So. 3d Ave.
Maywood, Illinois
THE FLUOR CORP.
403 W. Eighth St.
Los Angeles 22, Calif.

Viscosity Indicating Devices

FISCHER & PORTER COMPANY
County Line Road
Hatboro, Pa.
GENERAL ELECTRIC CO.
1 River Road
Schenectady 5, N. Y.
THE GERIN CORPORATION
P. O. Box 653
Red Bank, N. J.

Voltage Controls

GENERAL ELECTRIC COMPANY
One River Road
Schenectady 5, New York

Voltage Regulators

AMERICAN BOSCH CORP.
3664 Main St.
Springfield 7, Mass.

BURLINGTON INSTRUMENT CO.
203 N. 3rd St.
Burlington, Iowa

GENERAL ELECTRIC COMPANY
One River Road
Schenectady 5, New York

Volt-Ammeters, Clamp-on Type

See also "Ammeters"; "Meters, Electrical Indicating".

WESTON ELECTRICAL INSTRUMENT CORP.
614 Frelinghuysen Ave.
Newark 5, N. J.

Washers

See also "Bronze Washer".

THE CLEVELAND GRAPHITE BRONZE CO.
17000 St. Clair Ave.
Cleveland 10, Ohio

Waste Heat Boilers

See also "Boilers, Waste Heat"; "Boilers, Exhaust Gas".

MAXIM SILENCER CO.
85 Homestead Ave.
Hartford 5, Conn.

Waste Heat Recovery Systems, "Vapor Phase" Cooling

ENGINEERING CONTROLS CO.
2835 E. 11th St.
Los Angeles 23, Calif.

Water Cooling Equipment

See also headings under "Coolers" and "Heat Exchangers"; "Exchangers, Heat".

AEROFIN CORPORATION
410 S. Geddes St.
Syracuse 4, N. Y.

BINKS MFG. CO.
3114 Carroll Ave.
Chicago 12, Ill.

THE FLUOR CORP.
403 W. Eighth St.
Los Angeles 22, Calif.

HARRISON RADIATOR DIVISION
GENERAL MOTORS CORP.
Washburn Street
Lockport, N. Y.

LILIE-HOFFMANN COOLING TOWERS, INC.
4239 Duncan
St. Louis 10, Missouri

Water Discharge Pipes

THE STEWART IRON WORKS CO.
P. O. Box 1039
Cincinnati 1, Ohio

Water Inlet Headers

THE STEWART IRON WORKS CO.
P. O. Box 1039
Cincinnati 1, Ohio

Water Purification Systems

CUNO ENGINEERING CORP.
80 South Vine St.
Meriden, Conn.

WORTHINGTON PUMP & MACHINERY CORP.
Harrison
New Jersey

Water Separators & Filters, Mechanical

WARNER LEWIS COMPANY
817 N. Lewis Place
Tulsa 8, Oklahoma

Water Softeners

WORTHINGTON PUMP & MACHINERY CORP.
Harrison
New Jersey

Water Temperature Regulators

THE POWERS REGULATOR CO.
2710 Greenview Ave.
Chicago 14, Ill.

Wearings Rings, Allan Red Metal, Copper-Lead Segment Form

A. ALLAN & SON
603 Bergen Street
Harrison, N. J.

Welding, Diesel Parts

BRODIE SYSTEM
115 Clifton Place
Brooklyn 5, N. Y.

RALPH STARK, INC.
43-12 33rd St.
Long Island City, N. Y.

Weldments (Steel Bases, Frames, Supporting Structures for Diesels)

THE STEWART IRON WORKS CO.
P. O. Box 1039
Cincinnati 1, Ohio

Whistle Gages

SCULLY SIGNAL CO.
88 First Street
Cambridge, Mass.

Windshield Wipers, Electric

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Wire & Cable

THE ELECTRIC AUTO-LITE CO.
Toledo 1, Ohio

Wrenches

SNAP-ON TOOLS CORP.
8064 — 28th Ave.
Kenosha, Wis.

Wrenches, Socket

SNAP-ON TOOLS CORP.
8064 — 28th Ave.
Kenosha, Wis.

Wrenches, Torque

AMMCO TOOLS, INC.
2100 Commonwealth Ave.
North Chicago, Ill.

SNAP-ON TOOLS CORP.
8064 — 28th Ave.
Kenosha, Wis.

Please Remember to Say — —

"I Saw It In Diesel Power and Diesel Transportation"

The Model 4FS2 Nordberg Engine

A SMALL two cylinder diesel engine has been announced by the Nordberg Manufacturing Company. The new model engine, the 4FS2, supplements the Type 4FS1 single cylinder engine which was introduced some time ago.

The new model is rated at 20 to 30 hp. at 1200 to 1800 rpm. and has a bore and stroke of 4½ by 5¼ inches. The four cycle engine is built as a complete, self-contained, ready to operate unit and can be used as an electrical generating set, pumping unit, with clutch or stub shaft power take-off for direct connection or belt drive and for marine auxiliary applications.

With the new model, Nordberg now has a line of diesel generating sets which provide 50 or 60 cycle ac. or dc. current from 6 to 20 kw. The pumping units cover a range from 200 to 2400 gpm. at from 25 to 220 foot head.

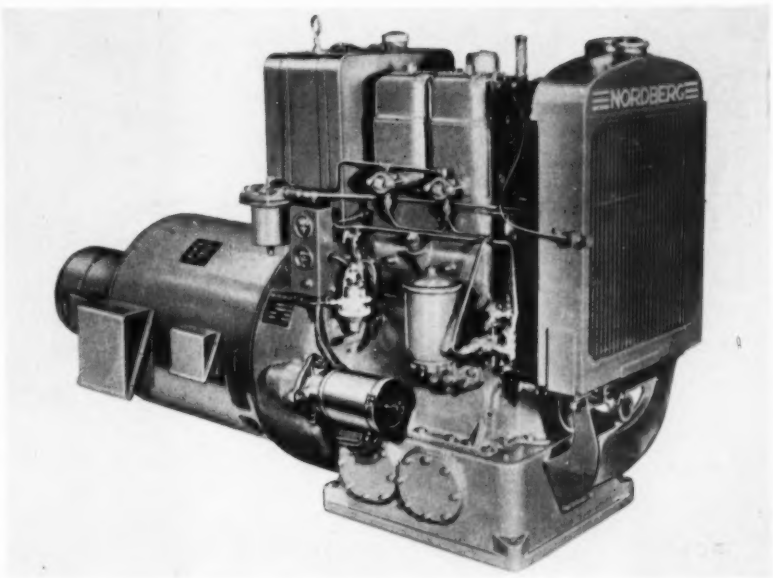
Simply constructed to provide ease of maintenance and operation, the new model is designed to start and operate on regular diesel fuels. Electric starting equipment including starting motor, battery charging generator and voltage regulator, is available along with manual starting. The engine can also be supplied for manual starting only, if desired.

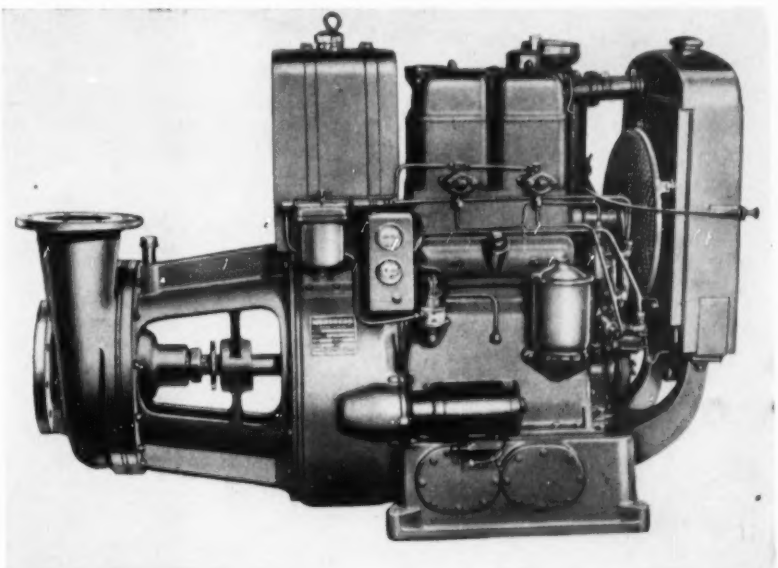
Full pressure lubrication is provided to main, connecting rod, piston pin and camshaft bearings and the rocker arm assembly. Lube oil circulation is maintained by a gear type pump located in the sump. Oil entering the pump passes through a float strainer and is then circulated through a tubular heat exchanger in the block. From here it passes to the various pressure lubricated parts of the engine.

A diaphragm type fuel oil transfer pump, actuated by the camshaft, can also be operated manually for priming. It is arranged to deliver fuel through a filter to the fuel injection pumps. The pumps deliver the fuel to the nozzles at high pressure through heavy steel tubing.

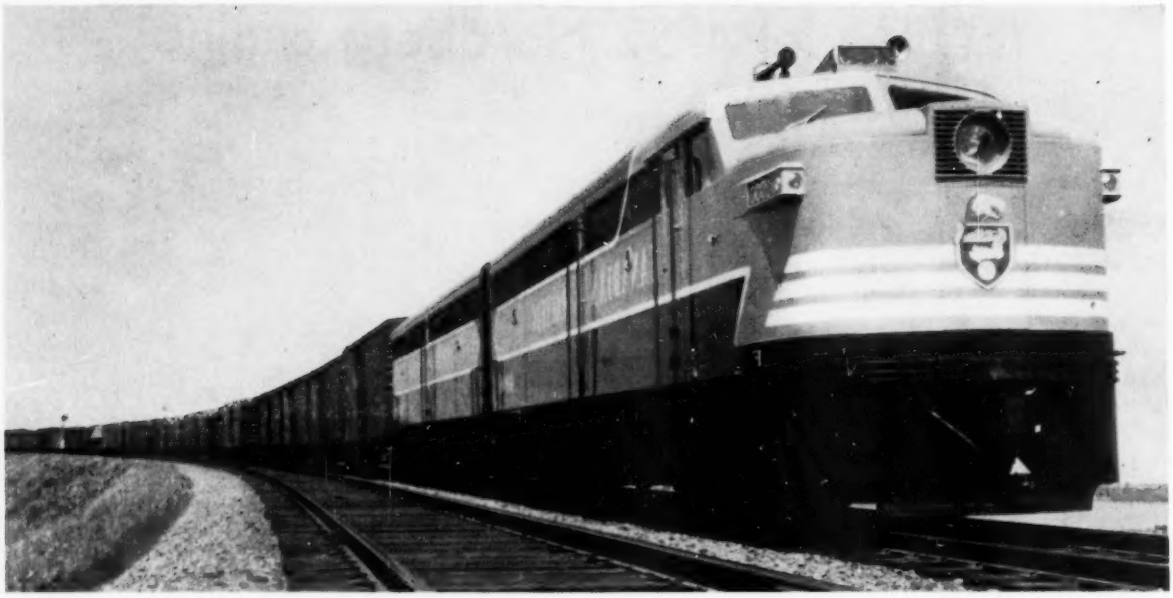
A mechanical flyball type governor, gear driven from the camshaft, regulates fuel delivered to the nozzles in accordance with engine load requirements. Engine speed is controlled by a simple adjustment of the governor.

The combustion chamber, fuel injection nozzles, valves and exhaust passages are cooled by radiator type cooling system. The fan and impeller type water pump are driven from the crankshaft. Automatic control of cooling water temperature is supplied by a thermostat and recirculating connection installed on the outlet manifold. Heat exchanger cooling for marine applications is also available and includes jacket water heat exchanger, surge tank, jacket water and raw water pumps, and the same automatic temperature control features.





(above) The new model set up as a diesel generating set and, (below) with a centrifugal pump attachment.



Canadian Pacific Dieselization Program

by Hugh G. Jarman

THE WORLD'S largest transportation system, the Canadian Pacific Railroad, is rapidly converting its railroad system from steam to diesel power. With $68,000,000 earmarked for the acquisition of diesel-electric locomotives in the next five years, the railroad will continue to pursue one of the most aggressive dieselization programs on the North American Continent.

The CPR includes a trans-continental rail line, a steamship line and a Trans-Pacific airline in its system. The railroad runs from Halifax, Nova Scotia, to Vancouver, British Columbia, a straight line distance of almost 3000 miles. It is the only trans-continental railroad operating on this continent.

The rail line has been definitely committed to a diesel policy by one of its chief executives, Mr. N. R. Crump, vice-president, who has said that his firm will not purchase any more steam locomotives. At the end of 1950, the line had 190 diesel units, which is a very large number when one considers the fact that the first diesel went into service on the line in 1943.

The first diesel units received and operated by the CPR were five 1000-hp. yard switchers. It was practically impossible to start a conversion program during the war. Immediately after the cessation of hostilities, the road decided to test diesel locomotives by converting one of its subsidiaries, the Esquimalt & Nanaimo, to diesels and using this division as a testing ground. The theory behind this move was that if the diesels showed good operating results on this division, the entire system would be converted, where practical. If the new form of motive power did not work out successfully, little would be lost.

The performance records of the diesels on the E & N showed the executives of the CPR that diesels did, indeed, have many advantages over the steam locomotives with the result that the road embarked on a large scale conversion program.

Because of the tremendous size of the CPR system, several factors had to be taken into consideration which did not enter into the picture when American roads considered conversion. The line runs across an entire continent, something which no American railroad does. This tremendous distance multiplies the problems encountered by the line and also multiplies the expense involved.

In any conversion program, it is not simply a matter of buying new locomotives and running them. Service points must be set up along the route and personnel must be trained to properly maintain and service the locomotives at these points.

Another problem encountered by the CPR is that of temperature extremes. The road runs in a mild climate during the summer but in the winter, temperature extremes are encountered which are met by very few American railroads. The cold climates introduce problems in operation which must be solved before conversion for efficient operation.

The CPR has met these problems by embarking on a program which will convert the railroad to diesel power, division by division. As mentioned previously, the E & N is completely converted and the Montreal-Boston line will soon be completely dieselized.

The policy of the CPR is to purchase diesel locomotives and use them where the greatest economies can be effected. In this way, large savings in operation

(opposite page) Alco-GE 3000-hp. locomotive pulling a freight consist. The "A" and "B" units shown are rated at 1500-hp. each. (above) EMD 2250 hp. diesel locomotive in passenger service on the CPR.

can be applied to future purchases and operations with the result that the road can realize immediate benefits from the program. As the program progresses, conversions will be made on other divisions which offer the possibility of smaller but still substantial savings until the entire road is dieselized.

The E & N was completely converted to diesels in 1948. At that time, the CPR received thirteen 1000-hp. Baldwin road switchers which now handle all traffic on the division. The Montreal-Boston line now boasts 23 diesel units which have replaced or are replacing 41 steam locomotives. The locomotive orders for the run were placed with Alco and EMD. Alco furnished 20 freight locomotives and switchers while EMD received an order for 3 passenger locomotives.

In addition to the diesels on the E & N and the Montreal-Boston run, the CPR also has several diesel locomotives handling freight on the heavily traveled run between Windsor, Ontario, and Wells River, Vermont. On this line, there are eight Alco-GE "A" units, four "B" units, five 1500-hp. road switchers and three yard switchers. This stretch of the CPR system is the connecting line between New England and the U. S. Midwest.

The dieselization program on the Montreal-Wells River run was not quite completed when the next phase of the program was announced by the road. This was a $12,000,000 order for 58 diesel units to be used in freight service between Fort Williams and Cartier, Ontario. This order was placed with two Canadian plants, 44 to come from the Montreal Locomotive Works and 14 from General Motors Diesels, Ltd., London, Ontario.

The Montreal Locomotive Works order includes 20 "A" units and 20 "B" units, all rated at 1500-hp., as well as four 1500-hp. road switchers. The GM order consists of ten freight-passenger "A" units rated at 1500-hp. and four 800-hp. yard switchers. The GM locomotives will be used for freight service only.

The 58 units ordered are intended to replace 68 steam locomotives now in operation on the Fort Williams-Cartier run. The 68 steam locomotives will be used on other divisions of the CPR.

Continuing its program of converting its line division by division, the CPR has obtained a three-unit 4500-hp. diesel locomotive from GM. This locomotive is being used for test purposes on the Schreiber Division and on the steep grades of the Canadian Rockies hauling the main transcontinental trains of the CPR.

The Schreiber Division covers the area north of Lake Superior. Here winter temperatures hover at the 50 degree below zero mark. The Division will present the diesels with the most severe operating test which they have yet encountered.

Steam locomotives show a marked drop in efficiency in cold climate. This is due to ambient heat loss and also a heat loss in combustion because of the cold air which must be used in the combustion process. The opposite is true with diesels since the very cold air provides what might be considered as a natural intercooling system which improves the efficiency of the engine.

It is because of the very cold climate encountered on the Schreiber Division that all locomotives intended for this section are being engineered according to special CPR specifications. Ironically, one of the locomotives replaced for the Western test runs is a Selkirk-type locomotive delivered in 1949, the largest steam locomotive in the British Empire or this country.

The dieselization program of the CPR is one factor which has stimulated American locomotive builders to open factories in Canada. General Motors has a large plant in Canada and Fairbanks-Morse also has set up a Canadian plant. Canadian General Electric is working in conjunction with Montreal Locomotive Works in much the same manner that Alco and GE cooperate here in this country. The GM plant is now in production and it is expected that the Fairbanks plant will be in production in the very near future.

The CPR has a very large capital expenditure program. Outlining the company's dieselization policies recently, Mr. W. A. Mather, president, said: "The continuance of dieselization represents an important aspect of our plans for capital expenditure." The line's total requirements for capital expenditures during the next five years will total some 400 million dollars. Expenditures for diesels and other improvements are expected to enable the road to establish an enviable operating record which will be a credit to the executives of the railroad as well as to the operating personnel and other employees of the road.

Diesels on the Columbia River Projects

by W. J. Granberg

DIESEL powered equipment is handling a large part of the construction of the world's largest reclamation and hydroelectric power projects in eastern Washington. Here the Columbia River is being harnessed to irrigate thousands of acres of arid land and to provide electricity for industries and homes.

A small army of men and hundreds of pieces of diesel equipment are at work on the Columbia Basin irrigation project, made possible by Grand Coulee Dam, while the construction of Chief Joseph Dam at a cost of $221,000,000 is just getting under way. Many miles of canals and concrete siphons criss-cross the bleak terrain below Coulee Dam, nearing completion for the day when enough water will run through them to supply the needs of every man, woman and child in the United States.

Ten of the world's largest pumps are being installed at Coulee Dam and early in 1951 they will prime the gigantic irrigation system for the first delivery of water. One pump alone will be capable of handling one billion, 36 million gallons of water in 24 hours. Water will reach the arid basin region in 1952, while it is expected that by 1959 there will be a stable supply for 500,000 acres, or half the irrigable land within the project.

GM Diesel-powered Le Tourneau Tournapull followed by a Cat D-8 bulldozer. In right rear is another D-8. Diesel rigs on this Chief Joseph job are moving 3.3 million cubic yards of dirt.

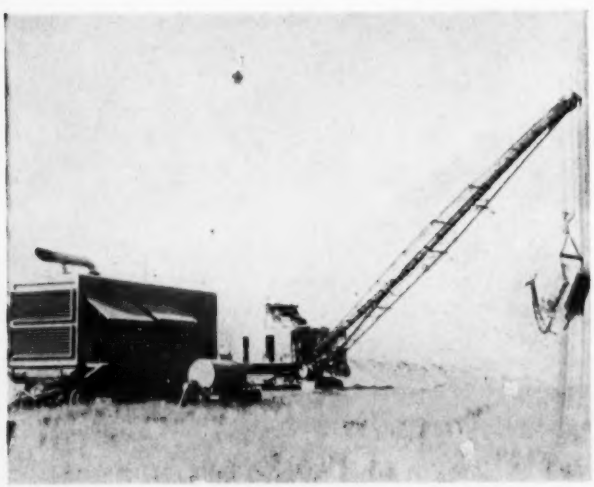
It is virtually impossible to detail all the diesel-powered equipment employed on the numerous contracts involved in the reclamation work. Each job may be many miles from the next one, separated by sagebrush and rocky country, but always marked by diesel cranes and shovels that loom against the horizon.

One of the largest ditch contracts is held by Western Contracting Corporation, of Sioux City, Iowa. The firm is building a section of the East Low Canal and Weber Wasteway near Moses Lake at a contract price of more than $1,500,000. The job calls for 10 miles of excavation work to establish a ditch 19 feet deep, 64 feet wide at the bottom and 100 feet wide at the top. To do this work, Western brought in what has proven to be the fastest dragline shovel on the entire Basin project.

The rig is a diesel-electric Model 51 Marion shovel swinging an 8½-yard Hendrix bucket on a 90-foot boom. It is served by a mobile diesel-generator unit, a 24-wheeled piece of equipment that was moved in by a D-8 Caterpillar.

The unit consists of a Model 12-567-ATLP General Motors diesel which produces 900 hp. at 744 rpm. This 12-cylinder engine, with a bore and stroke of 8½ x 10 in., drives a 625 kva. Westinghouse generator which powers a 500-hp. General Electric motor on the Marion. This motor, in turn, serves the General Electric generator which powers the 225-hp. hoist and travel motor, while a similar generator operates two 37.5-hp. swing motors.

As a result of this unusual coupling, the big shovel has more power than it ordinarily carries, which accounts for its earth-moving ability. It has taken out as much as 900 cubic yards of earth an hour. In a 24-hour day an average performance is around 21,-



Marion shovel and its diesel-generator set. The generator set, powered by G-M engines, provides power for the shovel and is trailer-mounted for easy movement.

000 yards. Aiding this shovel is a Model 111 Marion on another section of the ditch. Powered with a Cummins diesel, it wields a 5-yard bucket on a 90-foot boom.

Diesel-powered Euclid dump truck being loaded by a Northwest shovel powered by a Murphy diesel. At left are two more Northwest shovels.

Included in Western's contract is a concrete-lined ditch three miles long, along with turnout and check structures, which involve approximately 18,000 cubic yards of concrete. This was mixed at the site of pouring by a Model 34-E Koering Twinbatch Paver powered with a Cummins diesel.

One of the most spectacular contracts on the reclamation project was performed by the Utah Construction Co. and Winston Bros. Co. in a joint contract valued at $7,614,728 for building the Soap Lake Siphon. With a total length of 12,836 feet, the siphon included 8,250 feet of steel-lined section. The lengths of steel pipe, or "cans" which were placed in the ditch weighed 16 tons each. They were 20 feet in diameter and 22 feet, 4 inches long.

To place these cans in position in the huge ditch, a diesel-powered Manitowoc crane was gantry-mounted on a thack, with the whirley straddling the pipe and reinforcing steel already in place. A large C-hook, equipped with special hangers and connected to the boom of the crane, was used to pick up the cans and control the section, lowering while workmen juggled it into position. The crane, with a rated capacity of 60 tons, is powered with a Model D-17000 Caterpillar diesel engine.

This eight-cylinder diesel, with a bore and stroke of 5-¾ x 8 in. produces 190 hp. and easily handled the heavy and clumsy chore of maneuvering the steel pipe. The pipe sections were fabricated by welding in a yard not far from the ditch and were moved and loaded on low-boys there by a Type 302 Lima crane powered with a Cummins diesel engine.

As the Columbia Basin project jobs near completion, work gets under way on the Chief Joseph Dam hydroelectric power project, second only to Grand Coulee Dam in size.

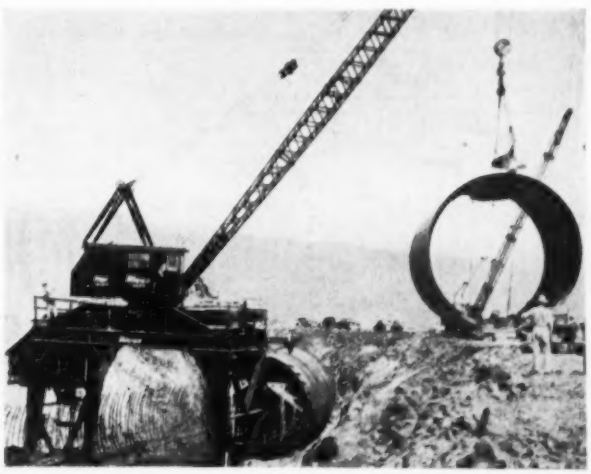
Initial contracts there include excavation for the intake channel to the powerhouse, a job costing $2,265,000 which is being done by General Construction Co., Seattle. Excavation of 3,300,000 cubic yards of earth and rock will provide a channel 3000 feet long, 1000 feet wide, with an average depth of 30 feet.

Here again diesel-powered equipment was summoned for the heavy-duty digging and hauling work. Machines and men are moving about 12,000 cubic yards of material daily, a quantity that sees trucks and haulers moving over the desolate landscape like taxicabs on a busy city street. Much of the digging is done by a battery of Northwest shovels, powered with six-cylinder Murphy diesel engines.

The earth and rock hauling work is carried out by a fleet of Euclid rear dump trucks powered with Model 8-TD Cummins diesel engines and nine LeTourneau carryalls and rockers powered with General Motors diesels. These latter rigs are aided by D-8 Caterpillar bulldozers.

Across the Columbia River, Peter Kiewit Sons' Co. is doing the excavation work for the right abutment of the Dam, along with 2000 feet of impervious blanket work, at a contract price of $2,572,544. Here again are diesel-powered Northwest shovels, Model 80-D, along with Cummins-powered Euclid trucks. This work constitutes the initial job on the Dam itself, site of which is 51 miles below Grand Coulee Dam. Award of contracts for the next stage is pending and this project, sponsored by the Army Engineers, will see hundreds of men and countless pieces of equipment massed beside the river for the next few years while the concrete dam and powerhouse are being built.

Gantry crane placing steel liner sections into position for the Soap Lake Siphon. The Manitowac whirey is powered by a D-17000 Cat diesel.



Cuno Reports on—

Basic Media and Fibre Study in Filter Development

Upon the occasion of the DEMA-M.I.T. Meeting, part of DEMA's Educational Program, Mr. J. A. Plummer, Cuno Engineering Corp., reported some of the results of over three years of work and study by his organization in conjunction with the Armour Research Foundation.

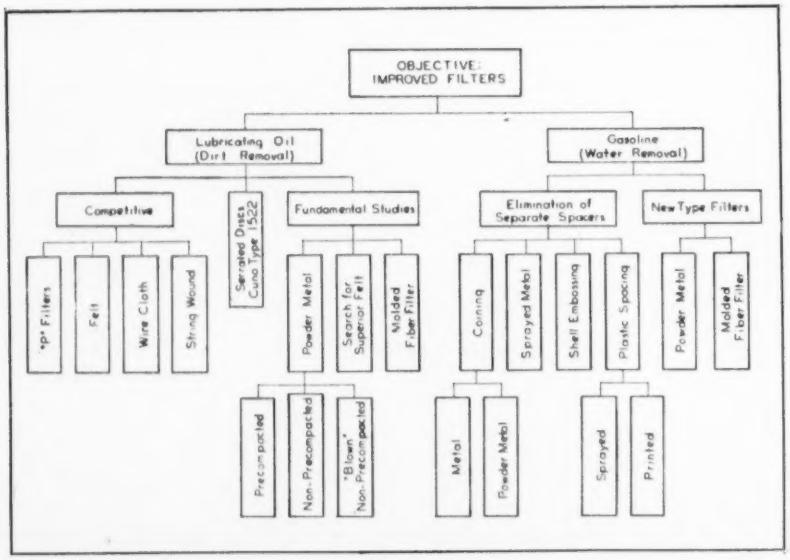
In his preliminary remarks, Mr. Plummer called attention to the fact that " . . . existent filtration media very largely occurred as an adaptive use of materials basically designed for other purposes and not originally conceived as filtration media." The object of the study was " . . . to concentrate on the development, as opposed to the adaptation, of material for filtration purposes."

IN instituting this study, the first step was the careful evaluation of the bulk of existing filtering media. Evaluation involves certain criteria and since such criteria must be uniform for any true comparative results, we enumerate here what we felt to be important.

1. Degree of filtration accomplished.
2. Flow rate versus pressure drop characteristics of the material.
3. Filter capacity, or dirt-holding characteristics.
4. Versatility for a wide range of fluids. (*Cuno has always attempted to serve a broad range of industrial filtration rather than the more restricted fields of lubricating and fuel oils.*)
5. Resistance to rupturing, channeling, collapsing and unloading, plus normal strength to withstand handling.
6. Effect of the media on additives.
7. Simplicity of structure and comparative cost.

Fig. 1 will show some of the materials evaluated. Time and space do not permit individual comment. Taken as a group, however, all the media evaluated fall short in respect to at least one, and generally more, of the criteria. We did get certain clues as to the proper direction for the next phase of our program. It was evident that there were materials available that did give sufficiently fine filtration for all practical purposes. But these were for the most part deficient in other respects, and particularly in short filter life and in high pressure drop characteristics.

Fig. 1 showing some of the materials evaluated by the Cuno Engineering Corp. in conjunction with the Armour Research Foundation.



During these investigations, nothing was found to exceed the cleaning efficiency of wool felt in the form of commercially available filtration materials. It was also quickly determined by comparison that commercial felts for other purposes and not specifically designed as filtration media, offered definite advantages in respect to life and cleaning efficiency.

Here, then, was our clue. If better materials were available merely by random selection, what would a thorough investigation of felted fibre media produce? Carrying this still further, what might not be achieved if we combined with this a basic study of fibres, particularly with reference to their felting and filtration characteristics?

Considering first the individual fibre, Fig. 2 will show some of those investigated. The upper portion of this figure refers to specific fibres, whereas the lower half refers to the particular fibre properties considered to be of primary importance.

Of these, fibre diameter, length, and another, (*not shown in Fig. 2*) structure, ultimately proved to be of the greatest importance for our purposes. Each of these properties had varying influence when assembled or combined

A fiber cartridge built by a controlled felting process.

by felting to obtain the final filter structure. For example, the first experimental felts attempted were essentially surface type units. When a fine degree of filtration is sought by means of a relatively thin medium, the relative freeness, which is a structural characteristic of the fibre or, in other words, its ability to arrange itself in a compact mass, is important in order to incorporate in this comparatively thin section the cleaning efficiency required.

In later stages when attention shifted from surface to depth type structures, the importance of this freeness characteristic still remained, but in reverse. With the depth type structure, it was essential that the fibre should resist matting or compacting to a dense mass.

The combined interplay of the various fibre characteristics and the structure of the assembled fibre mass provided infinitely complex possibilities. During evaluation of the first purely surface type felts, we also experimented with conventional methods of increasing surface area within a given space by such measures as pleating.

Contrary to normal practice, these pleats were produced during the felting process as an integral form or shape, and not by subsequent processing, as is done with certain surface paper media today. This point is important because the method of felting used, combined with the knowledge of felting properties of the fibres developed from our studies, did not restrict us to surface type units. Because of this, it was discovered that as we decreased surface area and substituted depth of felt we could not only increase the effectiveness of the material as a cleaner, but also increase the filter life or dirt-holding capacity.

There were also corollary benefits in the form of greater structural simplicity and strength. We followed this discovery with extensive exploration of the depth type media and arrived ultimately at a tubular shape having substantial depth of wall and with no additional surface area beyond that provided by its cylindrical shape. In form or outside appearance, our new filter assumed essentially the present shape or form.

During this phase we constantly had to change our fibre selection and mix. Whenever appreciable increases in depth of felt were tried, it became necessary to alter these factors. Gradually, the problem resolved to selecting the right fibre in diameter, length and structure and one that could be felted so that these fibres would be oriented to produce a controlled density and, if possible, a uniform controlled variable density to increase progressively in the direction of flow. Fig. 3, a photomicrograph of a cross section of our Micro-Klean cartridge as produced today, illustrates how this was achieved.

We found that it was also possible to vary this density over quite a range by varying fibre selection of mix, fibre length, diameter and fibre structure. These variations could be uniformly controlled and all with the same principle of graduated density. To illustrate this range, we are currently producing filter cartridges ranging from 10 micron filtration to 50 micron filtration. In our use of these terms, 10 micron filtration means positive removal of particles over 10 microns in size plus a substantial proportion down to 1 or 2 microns in size. The same principle applies to the coarser densities.

In accomplishing these various objectives, wool fibre continued to be all-important because of its scaly structure and probably much more because of its wave or crimp. Wool fibre is not a "free" fibre and this is necessary to maintain openness of structure in a depth type media. This openness of structure, or porosity, runs something like 85 to 90 per cent in our 25 micron cartridge. Variation in density is secured by using greater or smaller quantities of a "freer" fibre, generally a cellulose material.

During this work there was also the co-existent problem of providing struc-

Fig. 2. showing some of the fibers investigated. Note that the lower half of the table refers to fiber characeristics thought to be of primary importance.

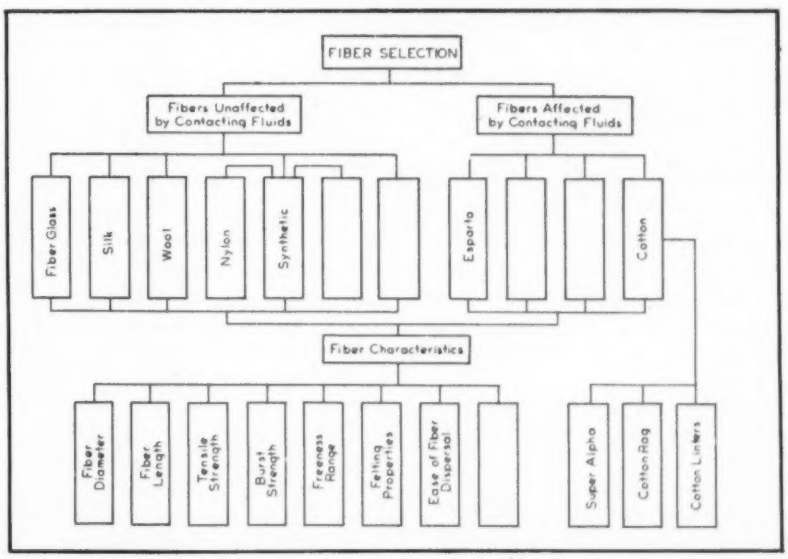


Fig. 3. Photomicrograph of the filter element shown on the previous page. Note graded density.

tural strength and resistance against channeling, rupturing, or other fibre displacement during use. We had to introduce an external element for strengthening, and we resorted to resinous impregnation. Such material was limited to thermosetting resins for heat resistance. Good resistance to, or compatibility with, the widest range of fluid was also necessary and ultimately we settled on a more or less conventional phenolic material. The result was a resilient filter structure capable of withstanding 70 psi. differential pressures.

It was now time to evaluate the result by applying the criteria covered earlier in these remarks. First, regarding cleaning effectiveness, we had a material that could be varied to meet the requirements of the application from the finest to the coarsest filtration.

Second, we found that we had a very low pressure drop versus flow rate characteristics. For example, a single 9¾-in. cartridge of 25 micron density will pass 2.5 gpm. of a 150 SSU. fluid with a drop of 2 psi. We attribute this to the openness of structure—the 85 to 90 per cent porosity—and to the absence of purely structural components, screens, cores, bags, liners, etc., to contribute to increased resistance to flow.

Third, we had a material with great versatility in handling a wide range of fluids from the more conventional petroleum products—lubes, fuels, and solvents—to such tougher problems as various acids, water and water solutions, varnishes and enamels, and many miscellaneous liquids.

Fourth, due to openness of structure and graduated density in depth, we get a relatively high dirt-holding capacity. For example, a single 9¾-in. 25 micron cartridge will accommodate 240 grams of Arizona Road Dust (fine grade) before pressure differentials reach 20 psi. (Initial pressure drops approximately 2 psi. in this test.)

Fifth, with respect to strength, we had a unit capable of withstanding 70 psi. differential pressures.

Sixth, the material proved to have no appreciable effect on additives contained in lubricating and hydraulic oils. There are no adsorptive or absorptive qualities of this type of material in finished form. The principle is straight mechanical filtration.

Finally, the cartridge is extremely simple. It seals at the end without gaskets by means of a permanent V ring seal cast in the housing. In multiple cartridge housings, the cartridges can be stacked one above the other with no seals required between them.

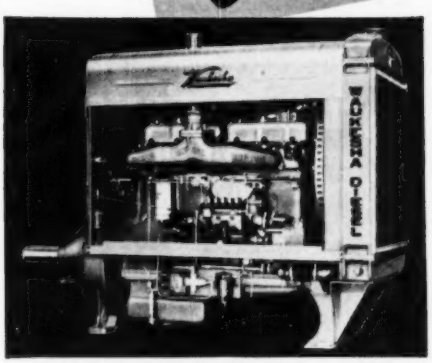
Obviously, the advantages of longer cartridge life, effectiveness of filtration, improved performance in all of the categories covered above are of interest and importance in the diesel field. The high flow rate characteristics, or conversely, the low pressure drop characteristics of the Micro-Klean type of filter media should be, and are proving to be, of great importance to those people who are interested in full flow, as opposed to by-pass filtration, largely due to the possible reduction in the size of the filter used.

In conclusion, it should be mentioned that we regard this project of research and development as one example of what the many manufacturers in the field of filtration are doing to keep pace with general industrial and technological progress. We do believe our product to be unique in its field, but our approach and methods of achievement are not unique. Other manufacturers are conducting investigations along similar and also completely different lines. We are continuing our own research as much work can still be done in the field of basic media and fibre study.

Filter of the multi-element type.

POWER *plus* PORTABILITY

WAUKESHA *Diesel* POWER



Model 148-DKU WAUKESHA DIESEL—Six cylinders, 5¼-in. x 6-in., 779 cu. in. displ., 180 hp. maximum.

● Quickly moved, and easily set up, to turn out a smooth uninterrupted flow of ¾-inch aggregate—100-125 cu. yds. an hour! This portable crushing, screening, loading plant is built by Highway Machinery Co., Waukesha, Wis. Its design emphasizes portability *and* power—Waukesha *Diesel* Power for capacity, dependability and low-cost operation.

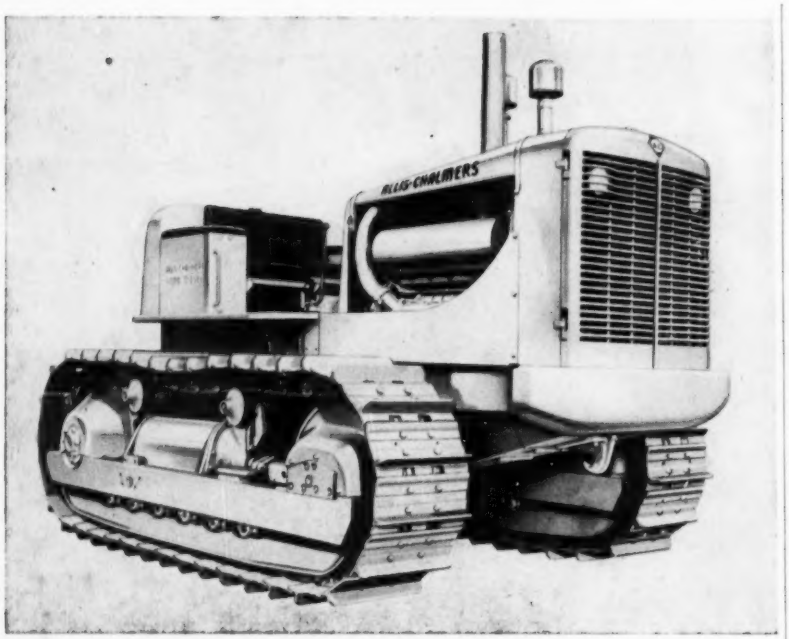
This plant has a special 10½″ x 36″ Dual Jaw Primary Crusher, with Roll Secondary Crusher, 4′ x 8′ Triple Deck Screen, feeder, drum elevator, and conveyors—and all equipment is powered by the Model 148-DKU Waukesha Diesel. Yet it handles every load demand eagerly and easily with power to spare . . . burning its fuel cleanly, without smoking on the job. Economical, too . . . and easy to start. And neither flying dust nor dirt deter it in the least. Easy to understand and operate, this Waukesha Diesel is a contractor's engine. Get Bulletin 1414.

107

WAUKESHA MOTOR COMPANY • WAUKESHA, WISCONSIN

NEW YORK • TULSA • LOS ANGELES

New Products



HD-20 Incorporates GM 6-110 Engine

Allis-Chalmers' latest torque converter equipped tractor, the HD-20 has just been introduced by the company's Tractor Division. A-C officials explain that 41,800 lbs. of properly balanced weight, long, wide sure gripping tracks, and the new 2-cycle GM 6-110 diesel facilitate handling the toughest jobs in stride.

This 660-cu. in. engine gives the HD-20 plenty of power to provide longer life, less maintenance and increased production. Maximum horsepower can be utilized regularly and maintenance held to a minimum. A three stage hydraulic torque converter eliminates most gear shifting and keeps the tractor working smoothly at higher average speeds. It automatically adjusts to the right speed at which engine horsepower and torque are high.

Operating adjustments, maintenance points and major assemblies are so located and designed that the care, maintenance and repair of the tractor can be accomplished with the least possible effort and loss of time. Simple unit construction allows removal or replacement of major assemblies without disturbing adjacent parts.

Oil Control Ring

A new oil-control ring was recently introduced by the Wilkening Manufacturing Co. The firm says that the ring, type CS8, represents a major improvement in multi-piece rings and is suitable for use in new, re-sleeved, rebored, tapered, out-of-round or distorted cylinders.

The chief feature of the new ring is the radically different expander, called the *Equalizer*. This piece is said to be completely independent of groove depth, does not touch the groove bottom and provides uniform radial pressure all around the ring circumference through tangential forces. These forces are set up by butting the ends of the expander and compressing it into the cylinder. Conventional expanders deliver their force radially by pushing at a few points against groove bottom and ring, the firm said.

Wrenches

A new design in wrenches in all sizes of combination and open-end is now being marketed by Bonney Forge and Tool Works. The new line is said to be streamlined, slim, light in weight and well balanced. The most careful engineering has gone into their design to make the tools easier to handle and easier on the hands.

The latest line of Bonney Wrenches is made in long and short series with the box wrench ends in either single or double hex. An important feature of the new design is the development of conveniently narrow heads, without sacrifice of the tool's strength, which permit the user to get into tight places. The wrench openings are accurately gauged to assure a firm hold on the nut.

Grinding Wheels

A new vitrified bond grinding wheel that is said to ensure a 5 to 10 per cent boost in grinding and finishing output to grinding wheel users is available from the Chicago Wheel & Mfg. Co. Called "79E", this new bond is recommended by the manufacturer for portable grinding of billets, brake drums, forgings and forging dies, annealed malleable castings, steel castings, centers and stainless welds, etc.

The bond is said to assure a smoother, faster cutting action for vitrified grinding wheels operated at speeds up to 6000 fpm. Longer production time is provided with lowered down-time for change-over or wheel dressing afforded.

Pin-Fitting Machine

A new pin-fitting machine has been introduced by the Van Norman Co. According to the firm, the new rig is designed to do six things: bore wrist-pin holes in pistons and rods concentric with the original hole or with worn bushings; bore piston-pin and bearing holes parallel; maintain proper center distances at all times; finish-

bore semi-finished babbitted rods; finish-bore rod forgings; and bore kingpin bushings.

The machine incorporates the "*Gyro-Matic*" boring principal which is said to assure exceptional accuracy and also has an automatic sizing device claimed to assure factory tolerances the first time.

Automatic Load Transfer Switch

An automatic load transfer switch which transfers load to standby generator sets when normal power sources fail has been announced by the G & W Electric Specialty Co. The complete unit consists of a 7500-volt, 3-pole, 400-amp load-break oil switch and an automatic operating mechanism mounted on a frame of welded structural steel. Control transformers are mounted in the oil switch tank, and all control wiring is completed at the factory. Three connections—load, normal feeder and standby generator—are required before putting the unit into operation.

When the voltage of the normal power source drops to 65 per cent of normal, a control switch is actuated to start the diesel generator. A time delay relay in the control circuit allows the diesel generator to build up to full voltage before the switch operates to transfer the load. When the normal power source is re-energized the mechanism automatically returns the load to the power source and stops the diesel generator.

New Piston Ring

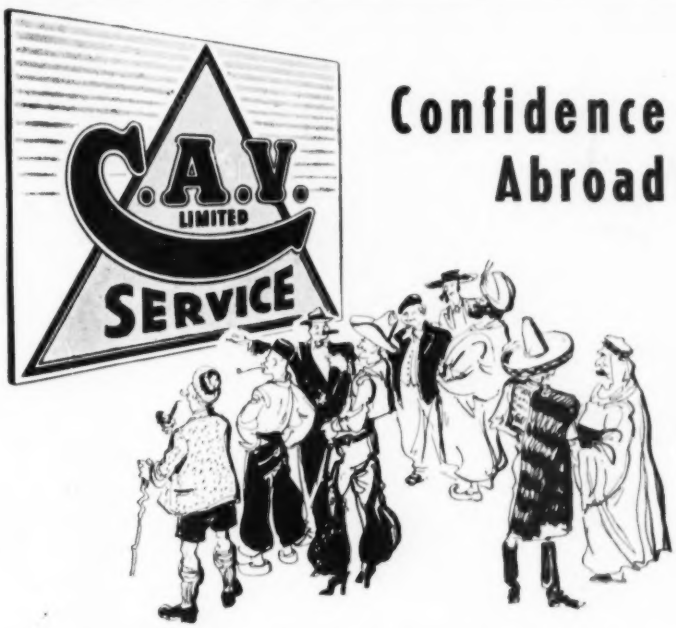
A new piston ring, especially designed to lessen the possibility of catching in cylinder ports, has recently

been introduced by the Double Seal Ring Co. The ring has been field tested in both two- and four-cycle engines for 18 months. Four-cycle users report the principal advantage gained by the use of the ring was less wear on cylinder walls and on the ring itself while two-cycle users listed these qualities but, most important, said that the rings greatly reduced ring breakage.

The one piece *Sealock* ring incorporates a feature which locks one of the ends "in" tightly against the other. This prevents the locked end from expanding into ports in the cylinder wall. In line with the growing trend toward the use of narrower grooves in pistons, the tongue of the new ring is much narrower than those on previous sealing rings. Other advantages claimed for the new ring are decreased blowby, lower fuel and lube consumption, better cylinder wall lubrication, and greater ability of the ring to compensate for tapering of the cylinder walls.

Valve Facing Machine

The Cedar Rapids Engineering Co. has announced a new valve facing machine called the Kwik-Way Model

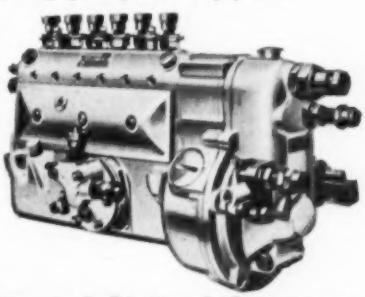


Confidence Abroad

Transport operators all over the world have learnt to trust this sign.

In any language the letters on the C.A.V. sign stand for first-rate service facilities, maintained by highly-trained craftsmen, using special precision equipment.

Wherever vehicles fitted with C.A.V. Fuel Injection Equipment are exported — whether to Trondheim, Santiago, Hong-Kong or Sydney—there's a service agent or depot to give it the specialist attention needed for such high-precision equipment.



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MAY EXACTLY FIT YOUR NEEDS

IF THEY DO, you will make large savings, Bronze-on-Steel bearings are extremely low in cost. They are manufactured by bonding pre-cast bearing bronze powder to strip steel, then forming to the required shapes. This combines an ideal alloy for the bearing surface with the strength and hardness of steel backing. These bearings have a higher Brinell hardness than cast bronze, much greater resistance to pounding and shock, and a comparatively low coefficient of friction. They are widely used in farm implements, in certain automotive applications, and many industrial applications. Perhaps you, too, should explore the possibilities of Johnson Bronze-on-Steel Bearings.

WRITE TODAY FOR FULL INFORMATION

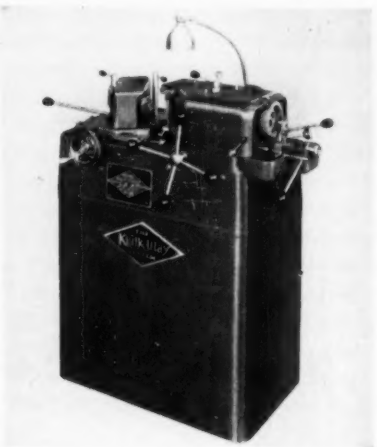
Johnson Bronze

SLEEVE BEARING HEADQUARTERS

470 SOUTH MILL STREET • NEW CASTLE, PA.

"W" Valve Master. It is a precision wet grinder designed for heavy duty refacing of large valves such as those in diesels and also for continuous duty on long production runs in refacing automotive and aircraft engine valves.

With quickly interchangeable chucks, the machine has a capacity for valve stems from 3/16 to 1¼ in. diameter.



Valve heads up to 6½ in. can be accommodated. The standard lever-operated chuck accommodates valves from ¼ to ⅝ in. and remains open at full capacity until released by the operator. The other range of sizes is covered by hand-operated chucks.

Control of all chuck operations is provided by a hand operated lever which instantly stops chuck rotation regardless of position of the grinder head. Speed, convenience and accuracy of angle setting is provided by built-in stops at 15, 30 and 45 deg. New features permit high speed precision grinding of rocker arms and facilitate surface or cut-off grinding. The grinder spindle is mounted on specially selected precision type preloaded ball bearings and the carriage operates in hand-scraped and lapped dovetailed ways. The machine is equipped with a 6 in. valve grinding wheel, 5 in. surface grinding wheel, and separate ½ hp. and 1/6 hp. grinder head and valve chuck motors. An independent motor driven coolant pump provides coolant to either grinder wheel from a 5 gal. capacity tank.

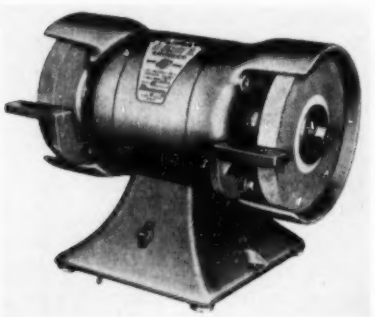
Reduction Clutch

A reduction clutch designed for small agricultural machinery, materials handling equipment, light road construction equipment, powered wheelbarrows, and other uses has been introduced by the Snow-Nabstedt Gear Co. The unit offers a 3.75 to 1 reduction in both directions and can operate in a range from 2 to 12 hp.

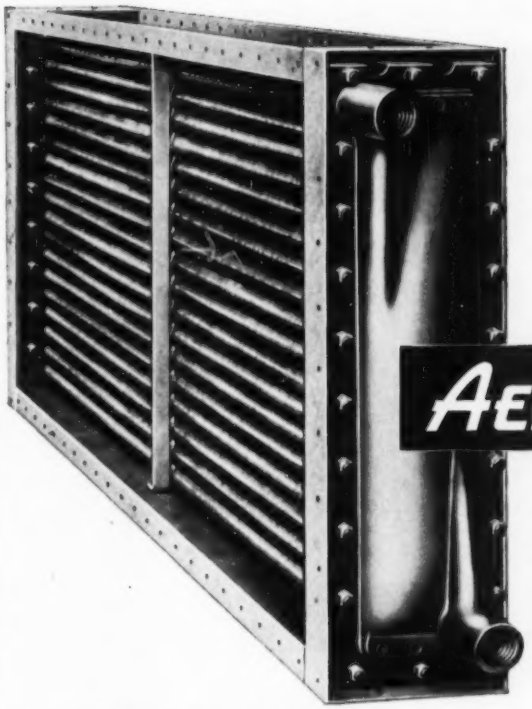
The features of the new unit are compactness, self-lubrication, quietness, ability to reverse under load and to slip the clutch if desired. Combining forward, reverse and neutral into one unit, use of the clutch may eliminate a gear box, clutch, countershaft, and supporting brackets in many cases. The unit measures 9-1/16 in. long, 8 in. wide and 9½ in. high. The firm has offered to assist manufacturers of original equipment in the efficient application of the unit by supplying engineering advice and counsel.

Utility Grinder

A utility grinder for use in tool rooms, maintenance shops, machine shops, manufacturing plants, etc., is



available from the Lima Electric Motor Co. Features of the new grinder include: dynamically balanced rotors; integrally cast wheel guards; adjustable tool rests that may be tilted for angular grinding; and long-wearing abrasive wheels. Specifications include: ¼-hp., 3450 rpm. dust-proof single phase a.c. motor operating on 60 cycle current at either 115 or 230 volts. The rig is also available for 2 or 3 phase a.c. 60 cycle, 220 or 440 volt operation. Also included are prelubricated sealed ball bearings and two wheels, 6 in. in diameter and ¾ in. wide across the face.



AEROFIN

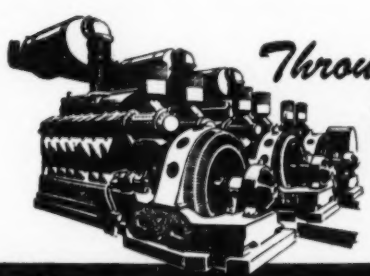
Heat-Transfer Surface

● High Efficiency
● Long Service Life
● Low Maintenance Costs

You are assured of high efficiency in heating or cooling—long service life—low maintenance and service costs, when you specify Aerofin extended-surface heat exchangers.

The reason is obvious: Aerofin makes heat exchangers *exclusively*—offers you the results of unequalled experience, unequalled production facilities, unequalled materials testing and design research—and the guidance of a complete, highly skilled engineering staff, at the plant and in the field.

For the most practical solution to your heat-exchange problem, ASK THE AEROFIN MAN.



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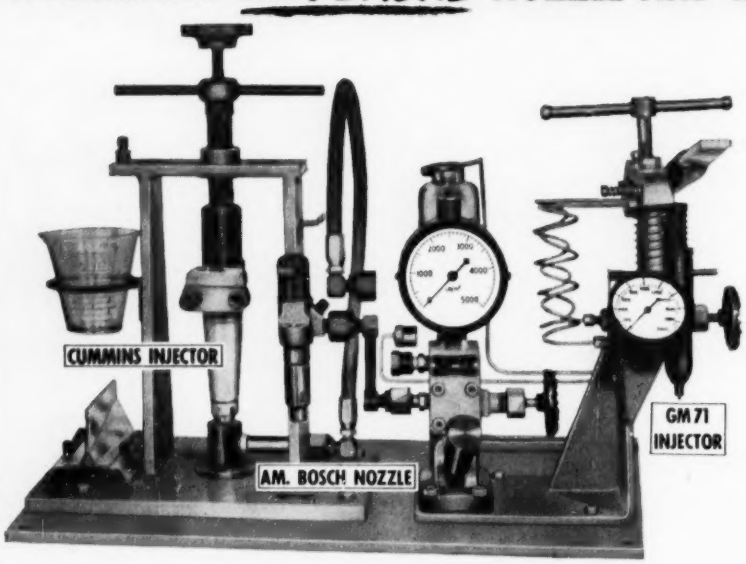
Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

BACHARACH *UNIVERSAL* NOZZLE AND INJECTOR TEST STAND



This is the most versatile and easy-to-operate piece of equipment ever offered for testing nozzles and injectors of all Diesels up to 60 hp per cylinder. The heart of this test stand is the Bacharach Nozzle Test Pump located in the center. Nozzles made by American Bosch, Bendix, Caterpillar, International Harvester, etc. are attached directly to test pump by means of steel tube and union nuts. Cummins injectors are held in test fixture at left; GM 71 injectors in test fixture at right. These fixtures have individual fuel pressure lines which may be interchangeably connected to test pump.

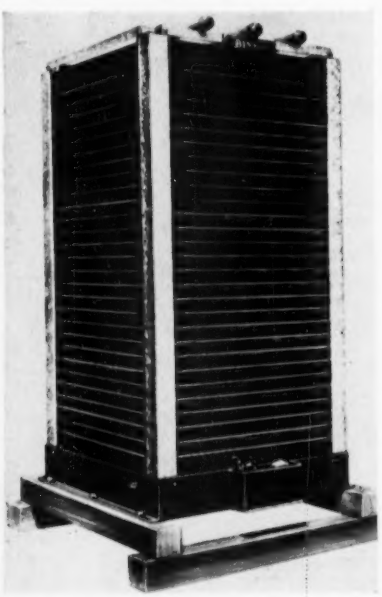
Test Set includes Connector Set 44 comprising connector tube, Ermeto adapter and fuel inlet connecting nuts for all American Bosch R, S and T size nozzles and similar size nozzles of other makes. Nozzle test pump or test fixtures may be purchased separately, if desired.

Write for Bulletin 901

BACHARACH INDUSTRIAL INSTRUMENT CO.—7000 Bennett St., Pittsburgh 8, Pa.

Cooling Tower

A new small capacity cooling tower featuring several advances in design has been added to the line of towers manufactured by the Binks Manufacturing Co. The new tower is known as the Binks Type "H". It is an atmospheric spray cooling tower for use with small "packaged" water-cooled air conditioning and refrigeration condensing units, and related applications. Type "H" towers are mass produced in 10 frame sizes with refrigeration loads ranging from 3 to 35 tons.

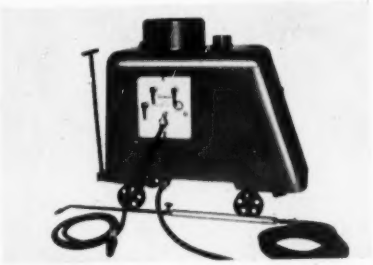


Among the features in the new towers are the following: the pan is made with external bolting flanges for convenient and firm anchoring of the tower. This improvement eliminates piercing the floor of the water basin. Assembly of the tower is simplified. Newly designed corner posts bolt easily and rigidly to the pan sides. Slip-fit louvers (either redwood or galvanized steel, as desired) slide into place through machine-slotted corner posts of new design which guarantee accurate spacing and angle. The float box is an integral part of the basin, and is mounted externally for easy access to the control valve.

The spray nozzles used in the towers are the Binks *Rotojets*. These clog-proof brass nozzles operate on a patented off-center inlet, whirl chamber principle. The high efficiency of these compact Type "H" towers is due, to a large extent, to the maximum fluid breakup obtained with the nozzles.

Steam Cleaner

A new combination steam cleaner and engine cooling system flusher, known as Model JO Hypressure Jenny with built-in Steam Thoro-Purge has been announced by the Homestead Valve Mfg. Co. The combination unit features an oil-fired electric motor driven steam cleaner which operates at 80 to 120 lbs. pressure and 90 gallons per hour water capacity and a cleaner that reverse flushes complete automotive cooling systems. The manufacturer believes that the rig will be especially useful to fleet operators, service stations, etc.

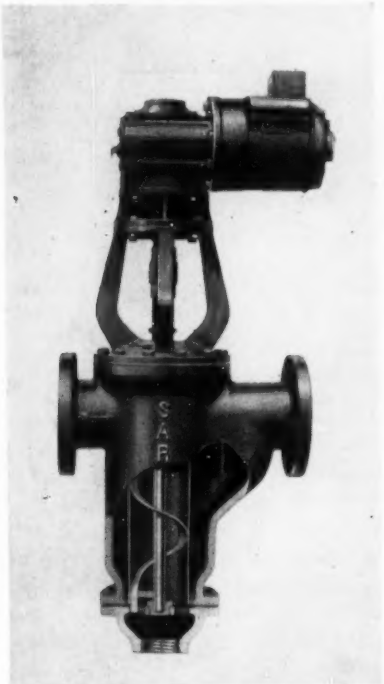


The steam jenny is recommended for all extra-heavy duty removal of grease and dirt. The cooling system cleaner employs heat, chemicals, sud-

den but safe temperature changes, and strong air blast to remove all grease, sludge and scale from the cooling system.

Pipe Line Scraper-Strainer

Operators of diesel plants using heavy fuel will be interested in a pipe line scraper-strainer recently introduced by the Sarco Co., Inc. The unit is made up of a cylindrical screen in-



side of which is a scraper which rotates like a worm gear. It is available either with or without a small electric motor which drives the scraper. In the event the unit is obtained without the motor, the scraper is turned by hand.

The unit is incorporated in a pipe fitting which is connected into the line carrying the fuel. Fluid flowing in the pipe line enters the strainer through the open top and passes out through the screened sides. Foreign matter is trapped by the screen and the scraper is passed over the inside of the screen at intervals. The foreign matter sumps down into a blanked-off pipe or similar device where it collects. When necessary, the foreign matter is removed from this pipe.

Cable Hoists

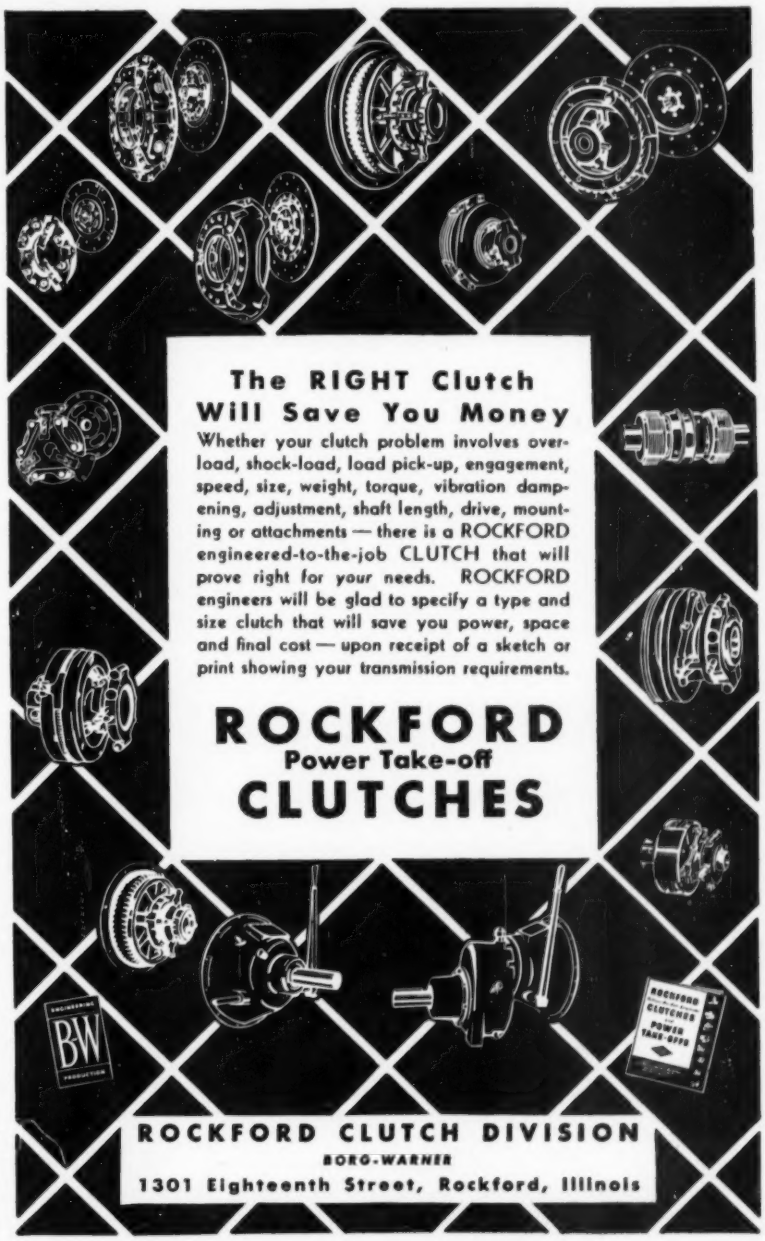
A new line of heavy-duty electric cable hoists is announced by the Cleveland Chain & Mfg. Co.

Hoists are manufactured in ½-1-1½-2-3 and 5-ton capacities. They will be sold under the trade name of "Bob-Cat" and, in addition to their availability through Cleveland Chain, will be distributed by other Round Associate Chain Companies located throughout the country.

An outstanding Bob-Cat feature is its total enclosure of the motor within the cable drum. This greatly reduces over-all dimensions and affords substantial weight savings.

Ball-Type Sockets

Five Proto universal power sockets and a universal joint, employing a ball-type coupling said to be much superior to the customary block-type, have been announced by the Plomb Tool Company. They are designed for pneumatic or electric power-impact wrenches with ½ in. square drive, but are equally


The RIGHT Clutch
Will Save You Money
Whether your clutch problem involves overload, shock-load, load pick-up, engagement, speed, size, weight, torque, vibration dampening, adjustment, shaft length, drive, mounting or attachments — there is a ROCKFORD engineered-to-the-job CLUTCH that will prove right for your needs. ROCKFORD engineers will be glad to specify a type and size clutch that will save you power, space and final cost — upon receipt of a sketch or print showing your transmission requirements.
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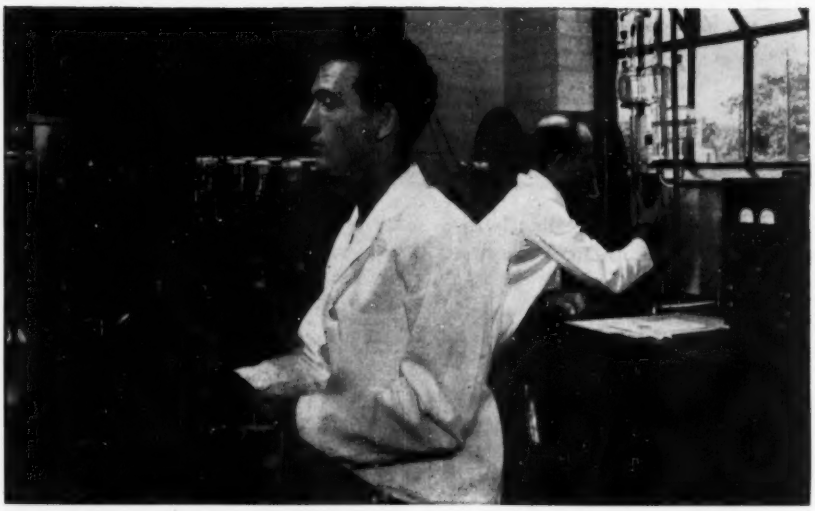
Centrifugal found the way...



. . . TO CHEAT THE SCRAP PILES (AT BOTH ENDS)

Specify

Centralloy

SLEEVES AND PISTON RING POTS are centrifugally cast in permanent molds from electric alloys. Castings rough-machined to specifications. Send today for complete specifications and/or sample castings.

Quality is a claim most manufacturers make but few can prove it as consistently and as effectively as Centrifugal. And anywhere along the line from beginning to end. Your scrap loss on Centralloy sleeves and piston ring pots should **average** less than 3% (and as low as 1.5%) according to the manufacturers we supply.

This same quality proves itself in performance as witnessed by the many engines with 100,000 miles hard service and still no breakdowns from sleeves of Centralloy.

Quality-control checks, as shown above, are taken every half hour at Centrifugal. These are the watch-dogs of Centralloy quality and high performance characteristics so highly valued by Centrifugal and their customers.

CENTRIFUGAL FOUNDRY COMPANY
MUSKEGON, MICHIGAN

serviceable on adapter-equipped 5/8- and 3/4-in. drive wrenches. The sockets have 1/2, 9/16, 5/8, 11/16, and 3/4 in. hexagon openings.

Some of the claimed features and advantages include: (1) Ball-type sockets operate smoothly at all angles and will not back off the work because force is evenly and constantly applied and they have no "dead spots" common to block-type universals. (2) The ball design is stronger and will stand more abuse than the block-type. (3) Only one pin is required.

Tumbling Machine

A new tumbling machine designed with an increased capacity for grinding de-burring and finishing metal parts is now being offered by the Grav-i-Flo Corp. The new machine is 68 in. wide, 64 in. deep and 68 in. high. With its two 24 x 40 in I.D. compartments, it is rated to handle a 30 per cent larger work load than comparable machines occupying the same square feet of floor space.

Other features of the machine are: compartments are furnished with ½ in. plate unlined or ¼ in. plate rubber-lined. Doors have cam locks with manually released safety stops to provide pressure relief. The magnetic starter has a reduced voltage control to meet plant electrical standards. A lever is standard on the machine but a push button switch is optional. A limit switch on the safety guard cuts off current to stop barrel rotation when guard is lifted. The 220-440 volt 5 hp. motor has a magnetic brake. Water and electrical services are integral with machine and available for instant, convenient connections. Safety guard is counter-balanced for easy lifting.

Lube Additive

Protektoil, a highly developed light viscosity heat resisting lubricant of very high film strength (38,000 psi.) with a pour point of 107 deg. below freezing, has been produced for year-round protection of both gasoline and diesel engines. When added to gasoline, used in top cylinder oilers, or in diesel fuel it is said to give increased power and better mileage, prevents internal corrosion and rust, eliminate gum, sludge and carbon formations, and keep fuel pumps, carburetors and injectors clean. The additive is made by the Protektoil Corp.

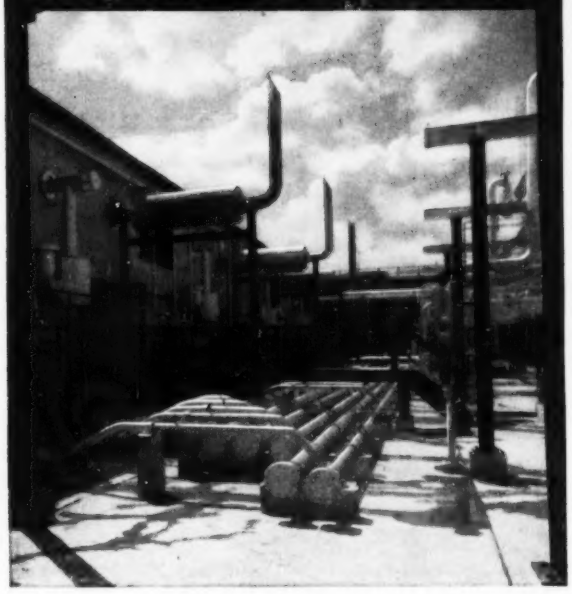
Wound-Rotor Motor

Electric Machinery Mfg. Co. announces a new line of heavy-duty, wound-rotor induction motors. These motors provide variable speed drive, and are also advantageous on applications requiring high starting torque and low starting current, or long acceleration periods.

Built in ratings from 30 to 1500 hp., drip-proof construction is furnished as standard on these motors. Splash-proof or enclosed, forced-ventilation, models are also available. The heavy-duty, fabricated steel frame features high physical impact strength and crack-proof steel-bar feet.

These motors are available with either ball or split-sleeve type bearings to provide long wearing qualities.

MAXIM SILENCERS



IN VENEZUELA

The photograph above shows three of the eight Maxim Silencers installed at the Creole Petroleum Corp., Mulata Crude Stabilization and Pressure Maintenance Plant in Venezuela. This compressor building houses eight 83-KVG Ingersoll-Rand Compressors with provision for increasing if necessary.

This is just another example of the broad acceptance of the Maxim name and Maxim products when silencing is required. Maxim's longer experience in the silencing field, backed by Maxim's progressive research and engineering staff, brings to each silencing problem the kind of specialized attention that means "more for your money." It's just common sense to "be sure it's a Maxim."

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THE MAXIM SILENCER COMPANY
93 HOMESTEAD AVE. HARTFORD 1, CONNECTICUT

Please send literature on the following silencers

☐ Intake ☐ Exhaust ☐ Spark Arrestor
☐ Steam Blow-off ☐ Heat Recovery

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Company _____

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MAXIM

Specify

COLUMBIA

A. C. and D. C. GENERATORS

- For Coupled Service
- For Belt Drive
- Single or Two Bearing

Columbia, with its years of experience, brings to generator set assemblers a wide line of performance proved, sturdily built, A. C. and D. C. Generators.

AC Generators: 6¼ to 1000 KVA
DC Generators and Exciters: 2 to 300 KW

•

Write for information. Our Engineers will be glad to review your requirements.

COLUMBIA ELECTRIC MFG. CO.
4537 Hamilton Ave. Cleveland 14, Ohio

Attention: Maintenance Superintendents and Owners of Diesel-Powered Equipment

HANCOCK

RECONDITIONED UNIT INJECTORS FOR GM 71 AND 567 ENGINES ARE AVAILABLE FROM OUR STOCK ON AN EXCHANGE BASIS.

HANCOCK Service Gives You:

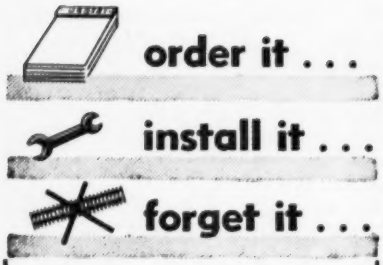
- One day delivery from our stock.
- The service of a modern injector laboratory completely tooled with the latest grinding, lapping and gaging equipment to handle all necessary work.
- A flat price for injector exchange regardless of condition of the plunger and bushing.
- A completely rebuilt unit injector that has been thoroughly tested after an actual run-in test.
- Any output of 71 engine injector available — 60 mm, 70 mm, 80 mm and 90 mm.
- An unconditional guarantee of satisfaction.

We will buy used General Motors and Caterpillar injection equipment.

Dealers write for our attractive proposition

DIESEL SERVICE DIVISION

HANCOCK MACHINE COMPANY, INC.
300 WALNUT STREET FINDLAY, OHIO



You can do that with ATLANTIC seamless diesel hose which requires no maintenance whatever.

Absolute uniformity of wall thickness . . . no seams or packed joints . . . absolutely tight against water, oil, steam, gas, air . . . dampens vibration . . . . maintains flexibility at extremely high temperatures.

Bronze, Steel, Stainless Steel, Monel — ⅛"—36" I.D. with fittings as needed.

Diesel Bulletins 1020 & 50A furnish complete information.

See our Catalog in Sweet's File for Product Designers.

ATLANTIC
METAL HOSE CO., INC.
109 West 64th St.,
New York 23, N. Y.

and are easily accessible for inspection and maintenance. Superfinished journals on split-sleeve type bearings provide a highly friction free surface. Brush pressure is easily adjusted with a ratchet wheel brush tension adjuster which provides metered step-by-step increase or decrease of pressure on the individual brushes. Finger tip removal of cover plates gives a big opening for easy access to the brushes and ease of cleaning.

Impact Wrench

A new Thor ⅝ in. "Silver Line" universal electric impact wrench was introduced at the Automotive Service Industries Show in Chicago, December 4-8 by Independent Pneumatic Tool Co.

Designed for heavy duty nut setting jobs on trucks, busses and other heavy automotive equipment, the reversible new wrench features the same basically designed mechanism used in an earlier model. All vital parts are larger, from the heavy duty Thor motor to heavier striking mechanism, mounted in a newly designed "cage" with steel inserts to insure long-lasting service on even the hardest jobs.

Operating at 2000 rpm., the wrench delivers 1,850 impact blows per minute both forward and reverse. Weighing slightly over 12 lbs. and measuring 11¾ in. overall, the new tool is equipped with a detachable head handle for easier handling.

Reversing Magneclutch

Vickers Electric Division, developers and manufacturers of the first commercially-usable, magnetic-particle-type clutch, has announced a new reversing or two-speed Magneclutch.

Vickers has designed the Magneclutch with two driving members and only one driven member. In such a clutch, the two driving members rotate continuously in opposite directions, and a simple reversing drive which is controlled by energizing the proper excitation coil is achieved.

A noteworthy feature is the single, low-inertia driven member. Because of this there is no backlash in the output shaft. The gearing arrangement used to cause the driving members to rotate in opposite directions from a unidirectional input need not be limited to any particular ratio.

Air Cleaner

A complete line of separators for cleaning compressed air by means of centrifugal force is announced by the Swartout Company. Known as the Swartout Airfuge, the separator is available in seven inlet and outlet tapping sizes, from ½ to 2½ inches.

According to the manufacturer, the Swartout Airfuge removes 99 per cent or more of all impurities from compressed air without pressure drop. Moisture, oil, scale and other solids in the air are whirled outward to the walls of the unit where they drain down to the trap section. At the same time the clean, dry air passes unimpeded to feed line.

Steam-Jet Cleaner

Livingstone Engineering Company announces a new steam-jet cleaning unit designed to make available to companies who have ample high pressure steam supply the advantages of the Speedyelectric system of steam-jet cleaning.

The unit includes a high pressure detergent tank mounted on a lightweight all-metal dolly with rubber tired 10 in. wheels and handle bar grips for easy portability; also 25 ft. of high pressure steam hose for connection to the source of steam and 25 ft. each of steam and detergent hose from the tank to the steam lance.

The unit is equipped with pressure gauge, 200-psi. safety valve, and all necessary control valves. It is built under the ASME code and carries National Board Stamping and Insurance Company Certificate. The detergent tank is thoroughly insulated and enclosed in an enamelled metal case.

In operation, the tank is filled with detergent or solvent and steam is admitted in the top of the tank to put the liquid under pressure. Detergent flows from the bottom of the tank through the detergent hose to the lance where it is atomized with the steam and directed at jet velocity, under finger-tip control of the operator, against the object to be cleaned. In

NEW...
300 G.P.M.
COMPACT
For Petroleum, Process and General Industries
ROPER
3600 HBRV
No. 7 PUMP

Highly efficient venturi suction and discharge principle for smooth flow; deep packing box with lantern ring for effective sealing and long packing life. Case can be fitted for steam heated operation at small extra cost. Ideal for thick viscous liquids. Driven by gasoline engine, geared head motor or power take-off for wide range of applications.
Capacity, 300 G.P.M.
Send for Literature.
ROPER Rotary Pumps
GEO. D. ROPER CORP.
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ROCKFORD, ILLINOIS

SAVE MONEY BY *KNOWING* WHEN TO OVERHAUL YOUR DIESELS
KIENE DIESEL INDICATOR will tell you Compression and Firing Pressures ...*FAST*

WHY GAMBLE?
With the KIENE DIESEL PRESSURE INDICATOR, you waste no money on costly overhauls done too soon—take no risk of putting off overhauls until too late.
The KIENE INDICATOR tells, reliably by accurate measurement of compression and firing pressures, when your engine needs attention.
SIMPLE—no complicated adjustments. **RELIABLE**—not affected by heat. **ACCURATE**—effects of friction and inertia eliminated. **RUGGED**—only one moving part. **COMPACT**—weighs less than ten pounds.
LOW IN COST—For full details, send for Bulletin K-100.
KIENE DIESEL ACCESSORIES, INC.
10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

the system of steam-jet cleaning, solvent, detergent or paint stripper can be applied either alone or mixed with steam in any desired proportion.

Crankshaft Alignment Indicator

Beekman Industries, Inc., announces the availability of their fully-guaranteed Beekman Crankshaft Alignment Indicator.

This instrument protects the engine operator from the heavy expense of mechanical breakdown due to fractured crankshafts, usually attributable to faulty crankshaft alignment, avoidable by the use of a reliable indicator during the erection and periodic servicing of the engine.

The indicator is suitable for use on all types of gasoline, diesel and dual-fuel engines of any make. The facility with which tests of split-hair accuracy can be made is greatly enhanced by the fact that the dial can be read in all positions of the crank. The indicator can also be used for checking connecting-rod bearing clearances, cylinder liner wear, deflections of beam and for other purposes.

New Literature

Amprobe Manual

A sixteen-page manual No. 110, "How to Make Your Job Easier with the Amprobe", the pocket-size, snap-on volt ammeter, is now available from Pyramid Instrument Corporation. It describes the functions of the new tool for anyone who installs, repairs, services or maintains electrical equipment.

The new manual also describes some of the many jobs on which this instrument can save time and trouble, and also explains the details of how to use it and how to read the scales.

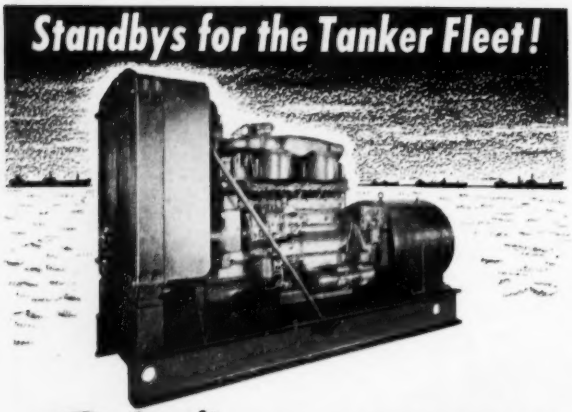
Baldwin Bulletin

Baldwin Locomotive Works announces a new 4-page bulletin, No. 321, covering Series 600 diesel engines. These engines have a 12¾-inch bore, 15½-inch stroke, and a speed range from 360 to 625 rpm. They include both naturally aspirated and supercharged engines for stationary and marine service.

The bulletin includes design features and specifications, performance curves, and ratings, which range from 430 to 1500 hp. Illustrations include cross sections, dimensional drawings and rating charts.

Fluor Bulletin

A four-page bulletin describing the Fluor Pulsation Dampening Piping System has been prepared by the Fluor Corp. A description of the system along with the basic principles involved is included. The bulletin points out that pulse-free piping provides "better safety, higher operating efficiency, improved flow measurement, and lower maintenance cost." The information contained in the bulletin should be of value to compressor stations, pipe line companies, and operating engineers in charge of such operations.



Reiner DIESEL GENERATORS

16 of the Reiner 60 KW Reiner Diesel generators shown above are serving as standby units on a fleet of gasoline and oil tankers built by a large eastern shipyard for one of the major oil companies.

Reiner equipment gets the call wherever efficiency, economy and dependability are essential. Whatever your power needs — generators, pumps or compressors—portable, stationary or marine — diesel, gas or gasoline driven — Reiner can meet your requirements with either standard or custom built units. It will pay you to check with Reiner engineers today. There's no obligation.

Free bulletins on standard units sent on request. Write today stating your requirements.

JOHN Reiner & COMPANY

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LONG ISLAND CITY 1, N. Y.
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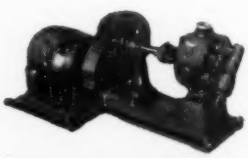
VIKING'S
Complete Line of
ROTARY PUMPS

"In all my experience of buying rotary pumps, I never saw the equal of the range in sizes and style of Viking pumps. No matter what I need, there seems to be a Viking built just for that purpose." So says one man looking for the answer to his rotary pump problems.

Don't forget, the next time you need rotary pumps, see Viking first. Check the complete line.

For a good start, ask for free bulletin 2201D today.



VIKING
AN HONORED NAME IN PUMPING

VIKING PUMP CO.
Cedar Falls, Iowa

See Our CATALOG IN SWEETS

Murphy Booklet

A new 28-page booklet entitled "10 Questions to ask a Diesel Engine Salesman" is being offered by the Murphy Diesel Company. The booklet asks and answers ten questions pertaining to diesel engine design and gives full mechanical details on the Murphy Diesel line of engines.

Hobbs Bulletin

A bulletin giving complete information on Hobbs Engine Hour Meters is available from the Hobbs Corporation. The bulletin gives a complete description of the meters and also includes a section on accessories. Such subjects as mounting, reading, operation, etc., are treated.

Cleco Catalogue

Cleco Division of the Reed Roller Bit Company has prepared a 24-page brochure on their line of products. The catalogue is divided into six sections which deal with such products as riveters, automatic hammers of all types, drills, reamers, tappers, grinders, impact wrenches, and couplings. Complete descriptions of the products are given as well as tables which can guide the prospective user in the selection of the tool which will fit his needs. The booklet contains many illustrations and cross-sections of the various tools produced by the firm.

Exline Brochure

A brochure describing the operations of the Exline Diesel Engine Works has recently been released by the firm. The 22-page booklet contains many photographs of the shop equipment and lays particular emphasis on their crankshaft repair methods, since this type of repair is a specialty with the firm. In addition to repairing diesel engines, the firm also represents several accessory equipment manufacturers catering to the diesel field.

Substation Booklet

Substations built from standardized components for rural distribution systems are described in a 12-page booklet "Westinghouse Standardized Substations for Rural Distribution Systems" (B-4697) recently released by Westinghouse Electric Corporation. Combinations of the various parts described in the booklet cover over 95 per cent of all rural substation requirements.

The booklet shows pictorially six of the more common substation arrangements. By folding over extended pages, different combinations of parts are shown on the basic layout. Bills of material dimensions, and symbolic diagrams are given for each combination.

Electricity Book

"Simplified Electricity for Utility Workers", a course in electricity for utility workers written by Percy R. Rutledge of the Central Hudson Gas & Electric Corporation, Poughkeepsie, N. Y., has recently been printed. The book, which sells for $10.20, has been prepared in 10 units. Such subjects as magnetism, motors, transformers, instruments and meters, generation, transmission and distribution are treated in the book.

The text was prepared for those persons who do not have a college degree and was written to be used either as the basis of a course in instruction for small groups or for the individual student working on his own. It is felt that this book will be of value to stationary plant operators who are desirous of teaching their personnel the basic considerations of power generation, transmission, and distribution.

Cutting Wheel Folder

A six-page folder announcing the new moisture-proof protection given its line of abrasive cutting wheels has been released by the Chicago Wheel & Mfg. Co. The publication states that the new packaging causes the wheels to last longer, cut faster, and do an allround better job than non-protected wheels and also says that the heat sealed glassine envelopes in which the wheels are now packed increase the efficiency of the wheels. The folder also says that the wheels are protected from dirt, oil or grease by the new package.

Alco Catalogue

Alco Products Division of American Locomotive Company has published a new 16-page catalog containing useful product information about heat exchangers, evaporators and feedwater heaters.

In addition to descriptions of the regular shell and tube line of heat exchangers, Alco has included expanded sections on its new industrial exchanger and the Alco Aircooler. A spread on productive facilities, and pages of photos showing a variety of Alco installations throughout industry are other features.

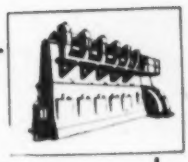
Westinghouse Booklet

The complete line of Westinghouse Electric Corporation indoor and outdoor air-disconnecting switches is described in a new eight-page booklet, B-4726, recently released. The booklet gives highlights on the design and operation of these switches, as well as application information to simplify selection. References to more detailed literature are included.

Switches listed include five outdoor types and two indoor types. Hookstick operated switches, both outdoor and indoor types for use when single-phase operation is permissible are covered. Other types described are for gang-operation, with or without arcing horns, for interrupting small magnetizing and charging currents and for no-load applications. Rotating- and tilting-insulator types of switches are shown and their applications described.

Aeroquip Bulletin

A bulletin which contains much valuable information on industrial hoses and fittings specifications as well as instructions on assembling fittings to hose lines has been released by the Aeroquip Corporation. The six-page folder includes illustrations of many different types of fittings as well as tables for the use of these fittings. A page is devoted to a description of self-sealing couplings and another to breakaway couplings, the latter designed for use on all hydraulically operated farm equipment.



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Stationary and marine engines of various sizes and makes available. Large selection spare parts for stationary and marine diesels.

We can save you money and make prompt delivery.

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2637 EL SEGUNDO
COMPTON, CALIF.
LOS ANGELES
PHONE: NEVADA 6-1505

Temperature Recorder

A continuous record of actual temperatures in refrigerated trucks, railway cars, warehouses, ships, and retail stores' units, is provided by the new Minicorder, a self-contained recording thermometer developed by the Tagliabue Instruments Division of the Weston Electrical Instrument Corporation.

With this new instrument, an accurate check of storage space temperatures is available to those engaged in the shipment, storage, or merchandising of commodities requiring refrigeration.

The Minicorder requires no connection to any power supply, yet records temperatures over a period as long as seven days without attention. A specially-developed shock-proof mechanism makes it particularly satisfactory for use in trucks, trailers, railway refrigerated cars and ships.

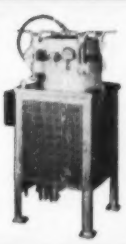
HILCO LUBE AND FUEL OIL PURIFICATION FOR DIESEL AND GAS ENGINES . . .

PURIFIERS · FILTERS · RECLAIMERS · CONDITIONERS

THERE'S A HILCO FOR EVERY LUBRICATION AND FUEL OIL FILTERING PROBLEM . . .

YOU WANT CLEAN OIL AND CLEAN ENGINES TO SAVE EQUIPMENT - OIL AND MONEY - INVESTIGATE HILCO OIL MAINTENANCE METHODS

★ WRITE FOR FREE LITERATURE - NO OBLIGATION



• THE HILLIARD CORPORATION, 120 W. FOURTH ST., ELMIRA, N. Y. •

IN CANADA — UPTON-BRADEEN-JAMES, LTD. — 990 BAY STREET, TORONTO, 3464 PARK AVE., MONTREAL

Field Notes

Oil Industry Program

For the fifth consecutive year, the domestic petroleum industry has scheduled the investment of more than two billion dollars for development, modernization and expansion of its facilities in this country. This is equal to $14.50 for every man, woman, and child in the United States.

On the basis of a survey, Frank M. Porter, president of the American Petroleum Institute, estimated capital expenditures of the nation's oil companies during 1950 at $2,400,000,000. Of this, all but $228,000,000 is earmarked for domestic facilities.

The $2,172,000,000 in 1950 raises the industry's postwar domestic investment total (1946 through 1950) to an estimated 10 billion dollars. If American expenditures overseas are counted in also, the overall total exceeds 12 billion dollars.

Westinghouse Men Honored

Two Westinghouse engineers were recently honored at the annual meeting of the American Welding Society in the Hotel Sherman, Chicago, Illinois.

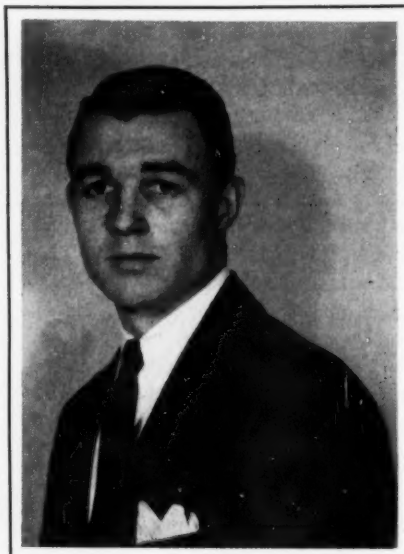
They are C. H. Jennings, engineering manager of the welding department at the Company's Buffalo, New York plant, and J. W. Kehoe, section engineer of the metals joining laboratory at the East Pittsburgh, Pa., Works.

Mr. Kehoe was awarded the $750 top prize in the 1950 Resistance Welder Manufacturers Association Prize contest, and Mr. Jennings was chosen as the 1950 Adams lecturer by the Society. Mr. Kehoe's award was based on his technical paper describing a practical method for obtaining consistently good resistence welds, and Mr. Jenning's lecture discussed the dynamic characteristics of dc. welding machines.

I. H. Tractor Tests

Three late model International crawler tractors recently tested were given maximum drawbar horsepower ratings considerably higher than those previously advertised by International Harvester Company.

The TD-24, International's huge 19-ton crawler, obtained a maximum drawbar horsepower rating of 148.43. This tractor, advertised by the company as the "world's most powerful," was previously rated at 140 dbhp. The second largest crawler in the company's line, the TD-18A, achieved a maximum drawbar horsepower rating of 89.29, as compared to the previously advertised 87 dbhp. rating. The third model, International's popular TD-14A, exceeded its former rating of 60.5 dbhp. with a new maximum rating of 65.9 dbhp. The maximum ratings are corrected to standard sea level operating conditions of 29.92 in. of mercury and 69 deg. F air temperature.



G. Renfrew Brighton

New Diesel Publications Officer

In a recent meeting of the Board of Directors of Diesel Publications, Inc., G. Renfrew Brighton was elected vice president of advertising and promotion. Mr. Brighton is the grandson of the late E. J. Rosencrans who was the founder of Diesel Publications, Inc.

A graduate of Dartmouth College, Mr. Brighton was previously associated with the Lockwood Trade Journal Co., Inc., and J. K. Lasser & Co.

Special Use Tax Opposed

Meeting in St. Paul, delegates to the 24th annual meeting of the North American Gasoline Tax Conference went on record as opposing third-structure road-use taxes and rejected the taxation of diesel engine fuel for highway vehicles on a basis of the use made of the highways since the same method is not generally followed in collecting gasoline taxes.

The Conference answered those states which have complained that they are "bridge" states and therefore receive little in fuel taxes. The group stated that in the final analysis every state is a "bridge" state.

The Conference admitted the impracticality of collecting taxes on a highway-use base. It would require a multitude of ports of entry in all 48 states and such action would be a fatal blow to interstate transportation.

It was recommended that the term "special fuel user dealer," sometimes used in specifying who shall collect the tax, should be considered as meaning any person delivering special fuels into the fuel tank of a vehicle. Such "special fuel use dealer" not only would collect the tax on special fuels but also would make such monthly reports and returns to the state as might be required.

In the symposium discussion which highlighted the Conference sessions, K. C. Littlefield, tax department manager, Cities Service Oil Co., New York, pointed out that much of the tax collection difficulty arises from failure to understand the difference between gasoline and diesel fuel. Gasoline, he explained, is a relatively unchangeable product from refinery to user, but diesel and kindred fuels may leave the refinery under any of several names, including designation, for example as No. 2 fuel for furnaces.

To minimize or overcome tax avoidance, Mr. Littlefield said the tax

should be levied on motor fuels at the point where the fuel is known to be for consumption in vehicles. And, he said, the tax should be levied in the same manner as that on gasoline. He conceded that such a policy might entail designating the fuel by a distinctive name, such, as "diesel oil," at some stage in the marketing process.

DEMA Officers for '51

At the annual meeting of the Diesel Engine Manufacturers Association, a three-day session held in Chicago on December 12, 13, and 14, the following officers and directors were elected for 1951:

President—Otto H. Fischer, president of The Union Diesel Engine Company; vice president—A. W. McKinney, executive vice president of The National Supply Company; vice president—Marvin W. Smith, president of Baldwin-Lima-Hamilton Corporation; treasurer—Robert H. Morse, Jr., president of Fairbanks, Morse & Co.. Directors include: William E. Butts, president of the Enterprise Division of General Metals Corporation; Levin H. Campbell, Jr., executive vice president of International Harvester Company; C. Paul Clark, president of Clark Bros. Co., Inc.; George W. Codrington, vice president of General Motors Corporation; M. C. Davison, vice president of Ingersoll-Rand Company; Robert E. Friend, president of Nordberg Manufacturing Company; Gordon Lefebvre, president of The Cooper-Bessemer Corporation; William S. Morris, vice president of American Locomotive Company; E. J. Schwanhausser, executive vice president of Worthington Pump and Machinery Corporation.

Harvey T. Hill was reappointed executive director of the Association.

Pullman in Tractor Field

On December 29, 1950, Pullman-Standard acquired the entire tractor allied equipment business of Isaacson Iron Works. The term "tractor allied equipment" refers to various accessory products such as bulldozers, scrapers, rippers, hydraulic power units, hauling winches, and other equipment utilized with crawler-type tractors, primarily in the earth-moving field.

These Isaacson products, now being manufactured at plants in Seattle, Wash., and Rockford, Ill., are sold in competition with similar equipment of other makes throughout the United States by the same distributors who handle the marketing of International Harvester crawler-type tractors on which Isaacson allied equipment is used. Foreign sales are handled through International Harvester Export Company.

Activities now carried on at Issacson's Seattle plant will be transferred as soon as possible to the Hammond, Ind., plant of Pullman-Standard. Operation of the Isaacson plant at Rockford, Ill., will be continued.

Voluntary Allocation for "Cat"

A voluntary allocation program designed to distribute equitably during 1951 heavy machinery manufacturerd by Caterpillar Tractor Co. for its world-wide dealer organization has been announced by Gail E. Spain, vice president.

here's an "EYE"

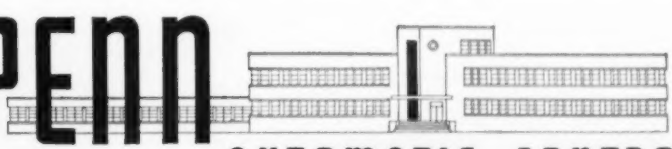
that never leaves the gauges

Like a hawk . . . every second, day and night . . . the PENN Safety Control "watches" the gauges so that overheated cooling water or oil pressure failure can't cause damage to your engines!

At the first sign of engine overheating or lubricating oil pressure failure, the PENN control *automatically* gives the alarm . . . rings a bell, flashes a light or shuts off the engine. Then you can investigate and correct the fault before damage occurs.

Learn more about this *low-cost, positive protection.* A few dollars invested in PENN Safety Controls will give you thousands of dollars worth of dependable protection for your engines. Write for Bulletin E-100 which fully describes the three basic models . . . oil pressure only . . . water temperature only . . . combination pressure and temperature. **Penn Electric Switch Co., Goshen, Ind.** Export Division: 13 E. 40th St., New York 16, U. S. A. In Canada: Penn Controls, Ltd., Toronto, Ont.

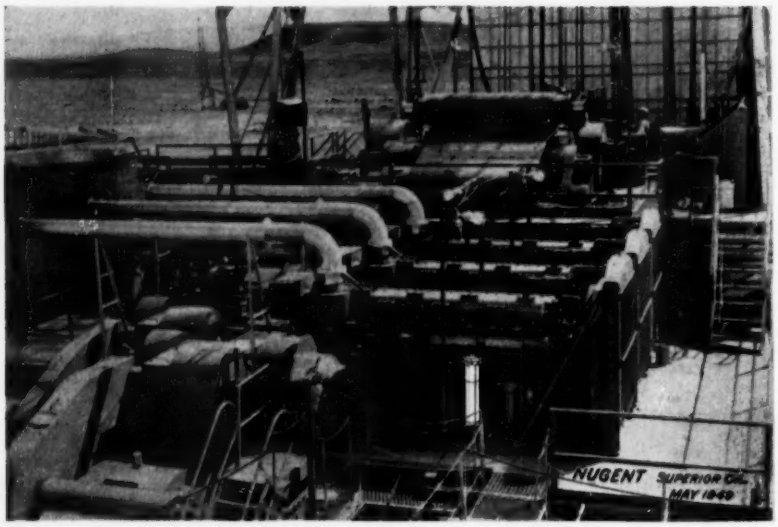
PENN



AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, PUMPS, AIR COMPRESSORS, ENGINES, GAS RANGES

Dependable
NUGENT FILTERS
really pay off here!



When you're making hole looking for oil, down time is a very expensive luxury. That's why Nugent Filters are used on so many drilling rig engines. The rig illustrated above is a good example—located in southwestern Wyoming at the time the photograph was made, the rig is one of the largest in the world. The three Superior supercharged dual-fuel engines deliver 2010 combined horsepower and each is equipped with a Nugent depth type pressure lubricating oil filter.

It's in installations like this where efficient, dependable Nugent filtering pays the biggest dividends but regardless of the type of installation, Nugent filters will pay for themselves in reduced oil consumption, longer equipment life and peace of mind.

Write today for descriptive literature which tells how you can utilize all these Nugent advantages. An outline of your filtering problem will bring specific recommendations.

NUGENT TRADE MARK

Wm. W. Nugent & Co., Inc.

417 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT-FEED VALVES, FLOW INDICATORS

Established 1897

Representatives in Boston • Cincinnati • Detroit • Houston • La Junta, Colo. • Los Angeles Minneapolis • New Orleans • New York • Philadelphia • Portland, Ore. • San Francisco Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

This is believed to be one of the first soundly-planned distribution systems put in operation by a major manufacturer. The system evolved from experience gained during World War II and for four years thereafter, and has already been accepted by Caterpillar dealers as the best mode of distribution under present market conditions. At present time the program applies only to track-type tractors, cable controls, bulldozers, and motor graders.

Despite vast post-war expansion of productive facilities, Caterpillar sales have outstripped their capacity; this trend becoming evident six months before the outbreak of Korean hostilities, with thinking by the time war broke out.

According to a letter directed to all dealers, domestic and export, Caterpillar's "new allocation program is planned in full view of the possibility that it may be superseded by government controls, and that priority orders —which may take precedence over all others—may be placed upon us (Caterpillar) even while we control distribution to civilians."

Railroad Dieselization Cited

Continued dieselization of American railroads has been "the most significant trend in motive-power developments" during the past year, The American Society of Mechanical Engineers heard recently at its 1950 Annual Meeting.

"Between the first of this year and September 1, the number of diesel-electric units ordered by domestic railroads has totaled 2433," Robert M. Coultas, transportation divisions, General Electric Co., said. "No new orders for steam locomotives had been placed with domestic builders for use in the United States during the current year."

He added, however, that several orders for steam locomotives of conventional design have been shipped by English and American builders for overseas service, primarily for India.

"Considerable activity in the extension of railroad electrification is evident throughout the railroad world, with the exception of the United

States," Mr. Coultas said. "Many countries have definite plans for electrification with the long range belief that electric power, whether generated in thermal stations or from hydro sources, will be the most dependable form for their particular economies."

He pointed out that in general, those countries which have no domestic fuel oil resources or in which oil is economically unavailable, appear to be moving toward electrification as an ultimate form of railroad motive power.

Referring to other forms of power, Mr. Coulter said that two new gas-turbine electric locomotives were placed in experimental running service during the past year, bringing the total number of this type of motive-power in actual running service throughout the world to four.

Alco Ordnance Organization

American Locomotive Company has established an entirely new organization at its Schenectady plant to handle ordnance production, while continuing intact its peacetime organization for the manufacture of diesel-electric locomotives, according to Duncan W. Fraser, chairman and president of Alco.

Railroad customers were assured in policy letter that Alco-GE locomotives and parts would continue to be produced at capacity levels, and that commitments on deliveries would be met just as in the past, unless national conditions affecting all builders interfered.

Railroad executives were reminded that the Defense Transport Authority of the ICC had requested a material program for new locomotives and maintenance from the National Production Administration. Mr. Fraser requested their "intense assistance" in this effort, pointing out that the ability to handle tremendously increased traffic certainly is one of the most urgent requirements of the defense economy ahead.

Alco will build the newly-announced medium tank described by the Department of the Army as "an improved General Patton with greater firepower".

NEW ENGLAND HEADQUARTERS
FOR DIESEL ACCESSORIES

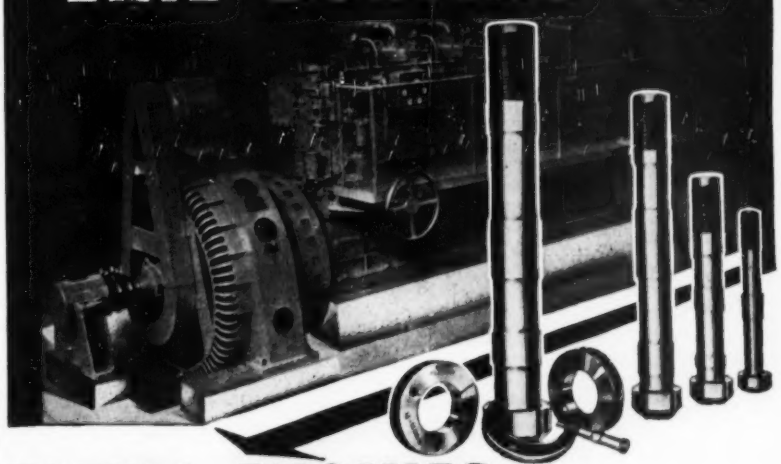
American Bosch
Bendix Scintilla
Briggs & Stratton
Delco-Remy
Stewart Warner
Auto-Lite
Leece-Neville

There's a reason why we've grown—since 1904—to be the automotive and Diesel leaders in this busy New England area. A recognized service organization geared for fast, intelligent handling of your specialized maintenance problems.

Carburetor—Diesel—Electrical
SERVICE

W. J. CONNELL CO.
121 BROOKLINE AVENUE BOSTON, MASS.

ERIE BOLTING on



DIESEL ENGINES

For over 30 years ERIE has manufactured bolts and studs to the specifications of Diesel Engine builders. This specialized experience gained in working with leading Diesel designing engineers assures you of getting the exact materials and the precise tolerance in bolting desired for your Diesel. Send us your specifications for Diesel Connecting Rod Bolts, Cylinder Head Studs, and other special bolting. Write for new price and data book.

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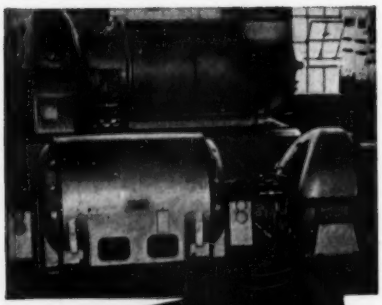
ERIE, PA.
A SUBSIDIARY OF Barium
STUDS • BOLTS • NUTS ~ ~ ALLOYS • STAINLESS • CARBON • BRONZE



Give YOUR Equipment that New Look!

IF your Diesels, generators, other heavy equipment look a little "seedy"—smarten them up with Oakite Renovator. All you do is give them a quick rub-down with this specialized paint cleaner. Then follow with a dry-cloth polish to bring out high paint-luster.

Oakite Renovator is a solvent-emulsion type cleaner. It goes after grime in a hurry. As to fire risk . . . nothing to worry about! Oakite Renovator is mixed with water . . . it's safe to use. And from a cost angle . . . Oakite Renovator is extremely economical . . . it stands dilution very well.

FREE MANUAL gives complete story on keeping equipment clean and ship-shape. Manual also describes 70 other ways to save time and money in power plant maintenance. Discusses such subjects as

- **Descaling Cooling Systems**
- **Repair parts degreasing**
- **Reconditioning filters**
- **Cleaning hard-to-reach places by Steam-Detergent Gun**

You may have a free copy of this helpful manual merely by dropping a line to address below. No obligation, of course.

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22C Thames Street, NEW YORK 6, N. Y.
Technical Service Representatives Located in Principal Cities of United States and Canada

OAKITE
SPECIALIZED INDUSTRIAL CLEANING
MATERIALS • METHODS • SERVICE

Obituary

Dudley G. Bolton

Mr. Dudley G. Bolton, for many years branch manager for Fairbanks, Morse & Co., at Dallas, Texas, passed away in a Dallas hospital, November 1, 1950.

He was born May 8, 1871, in Illinois, and reared in that state. He joined the Fairbanks, Morse organization in January, 1906, and had numerous sales and executive jobs with the company, being branch manager at Denver, Colorado, Salt Lake City, Utah, and Dallas, until he retired some years ago.

He was one of the best known men in the machinery industry and had a host of friends throughout the country.

He is survived by his wife and daughter, Mrs. Weldon L. Moore, also one grandson, all of Dallas, Texas.

Organizational News

Socony-Vacuum Retirement

J. G. Christopher has retired from Socony-Vacuum Oil Company, Inc., after 40 years' association with the company. He was eastern railroads sales representative in the national accounts department. He is succeeded by

"AMOT" THERMOSTAT

Complete Line Now Available
From ½" Pipe Size To 6" Pipe Size

Regulates engine jacket water or lubricating oil temperature automatically.

Cold engines are inefficient and good hand regulation is impossible. "Amot" thermostats are simple, reliable and low priced.

"Amot" thermostats were designed expressly for engine use and are entirely self-contained with no external lines or bulbs. No adjustments or servicing are ever required. All models are of the by-pass type with positive 3-way valve action. Insensitive to pressure variations.

Write for catalog and recommendations.

AMERICAN MOTORS CO.
21 NEVIN AVE. RICHMOND, CALIF.

SAVE $ $ $ — LARGE VOLUME, SMALL PROFIT

Lot No.	Quantity	Size	Manufacturer	Model	Condition	Price Each
1	2	500 H.P.	Cleve. Div.	8-268A	Rebuilt	$ 5,995
2	2	500 H.P.	Cleve. Div.	8-268A	Guaranteed	6,995
3	2	900 H.P.	G. M.	12-567	Rebuilt	7,995
4	2	1600 H.P.	F-M.	38D818	Rebuilt	15,595
5	1	200 H.P.	Graymarine	671	Rebuilt	1,295
6	5	225 H.P.	G. M.	671	Used	2,695

SPECIAL POWER PLANTS — 10 K.W. to 1000 K.W. — AC and DC

Lot No.	Quantity	Size	Current	Make	Model	Condition	Price Each
9	5	20 KW	DC	G.M.	271	Used	$ 1,595
10	2	20 KW	DC	G.M.	271	Rebuilt	1,895
11	4	30 KW	AC & DC	G.M.	371	Used	1,795
12	2	30 KW	AC & DC	G.M.	371	Rebuilt	1,999
13	2	60 KW	DC or AC	G.M.	671	Rebuilt	2,150
14	2	60 KW	DC or AC	G.M.	671	New	3,195
15	1	25 KW	DC	F-M	36A	Rebuilt	1,595

Lot No. 17: New Twin Disc Clutch 1:5 to 1, $295; 2:1 to 1 395
Lot No. 18: Spare Parts for G.M. 671, 271, 371, 258's, 3-268A, 8-268A.
Lot No. 19: EXCELLENT Patrol Craft Ship with G.M. Engines, All Steel, 172 ft.

F.O.B. WEST COAST—SPECIAL TERM; FOR CASH—EXPORT ORDERS: U. S. DOLLARS.
COMMISSIONS: Will Protect You on Any Overages Added on These Prices.
The Above Quotations Are Subject to Prior Sale, Final Confirmation, and Price Change
WE ARE IN THE MARKET FOR 20, 30 KW G.M. UNITS AND ALL TYPES OF EQUIPMENT

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(24-Hour Service)

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SHIP AND POWER EQUIPMENT

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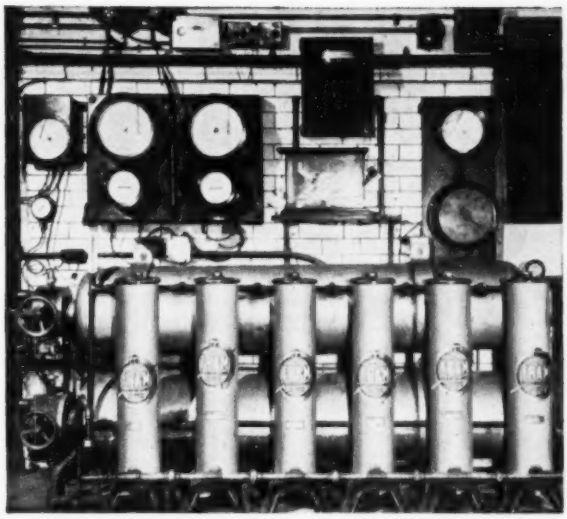


These six Fram Filters serve 840 h. p. Fried Krupp Diesel at large eastern university. This Diesel drives a 600 kw. Crocher-Wheeler generator.

University Cuts Maintenance Costs of Diesel Power Plant with FRAM Filters

Four Fram Filter installations filter dirt, grime, sludge and carbon from lubricating oil of 545 h.p., 630 h.p., 840 h.p. Fried Krupps and a 448 h.p. Baldwin in power house of large eastern university. Engineers consider Fram Filters the best . . . definitely a money-saver. Absolutely no maintenance except changing cartridges.

FRAM Filters Cut Diesel Downtime!

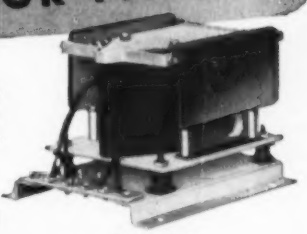
No matter what your Diesel oil filtering problem—either fuel or lube—Fram can help you conquer it. Fram's Research Department can determine the exact Fram Filcron Oil Filter you need to keep injectors clean and efficient . . . to keep vital moving parts free from engine-killing dirt, dust, grit, sludge and abrasives.

If you're interested in getting *top* efficiency, *top* performance from your Diesels, write for full information today to FRAM CORPORATION, Providence 16, R. I. *In Canada:* J. C. Adams Co., Ltd., Toronto, Ontario.

FRAM *Filcron*

THE MODERN OIL FILTER

Burlington GENERATOR VOLTAGE REGULATOR TYPE WA



Designed for use in regulating the voltage of A.C. generators in Stationary, Mobile or Marine installations.

Direct rheostatic action provides a simple, effective and automatic means of regulating voltage by performing the function of an automatic field rheostat.

Rating of rheostatic element is 2 amperes maximum exciter shunt field current at full load and power factor. Maximum sigma watts is 50 watts.

FEATURES

- Direct Acting
- Fast Response
- Automatic Control
- Small, Compact, Self Contained
- Rugged Construction
- Rheostatic Action
- Inexpensive

Inquiries for complete information and engineering services solicited.

BURLINGTON INSTRUMENT CO.
DEPT. B-11
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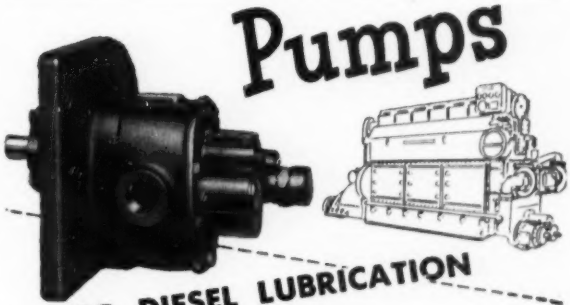
Pumps



FOR DIESEL LUBRICATION

THE rotary geared pump shown above is particularly suited for diesel lubrication systems. It has a special flange mounting to facilitate installation together with provision for tachometer drive.

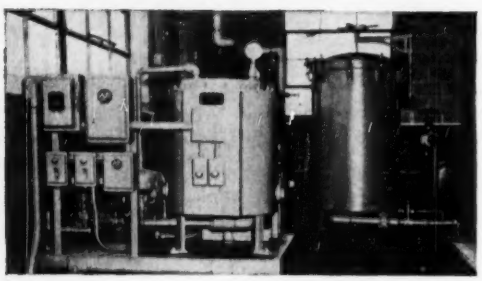
Thousands of Brown & Sharpe Pumps are now providing trouble-free service for transfer, lubrication and booster systems. Get acquainted with their reliability and economy. Write for Catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

We urge buying through the Distributor

BROWN & SHARPE BS

Hoffman I-718-18 cartridge filters provide continuous full-flow or shunt filtration of lube oil for this and other diesel engines on the Mid-Valley line. Cover-lifting device and swing bolts speed removal of head for replacement of "throwaway" cellulose cartridges.

Lube Oil Clarity for Pump Station Diesels of Mid-Valley Pipe Line Protected by HOFFMAN Filters



Reclamation of lube oil to like-new standards is accomplished by Mid-Valley stations with Hoffman I-18-10 Vaporizers. Soluble impurities (such as light ends and water) are removed by heating lube oil, in batches, with automatic heat and flow control.

For the gas-diesel and straight diesel engines of Mid-Valley's pumping stations, 9 Hoffman cartridge Filters and 3 Vaporizers maintain lubricating oil with these advantages: The cartridge filters, directly connected to the engines and standby oil pumps, provide continuous or intermittent operation, either full flow or shunt. Hoffman's exclusive cover-lifting device and simplified swing-bolt assembly, speed replacement of 7 x 18 inch cartridges. As an adjunct, the Hoffman Vaporizer removes solubles, at full flow rates, without the high maintenance cost of centrifuges.

FREE Filtration Engineering Service

For the right answer to your filtering problems, a Hoffman filtration engineer will survey your needs — make recommendations based on detailed analysis of solutions, oils and other factors. Ask for this service — there is no obligation.

FILTRATION DIVISION U.S. HOFFMAN MACHINERY CORPORATION
214 LAMSON STREET, SYRACUSE 6, N. Y.
CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET, ONT.

M. G. DeForest, who has been acting sales engineer for railroads. G. A. Hope of the gasoline and fuel oil department succeeds Mr. DeForest.

Drew District Manager

The Power Chemicals Division, E. F. Drew & Co., Inc., has announced the appointment of Perry S. Lawrence as the Southwest district manager.

Mr. Lawrence has been a member of the Drew organization for a number of years and has had wide experience in the use of power chemicals. He is a chemical engineer and has acted as a field service representative working on special assignments out of the New York City office. Mr. Lawrence will be responsible for the sale and service of Drew Power Chemicals in Texas, Arkansas, Oklahoma and Louisiana.

Caterpillar Changes

Broadening of the executive structure of Caterpillar Tractor Co. is announced by Louis B. Neumiller, president. The change includes creation of an additional executive vice presidency together with promotion of four administrative and departmental heads.

Personnel figuring in the announcement and their new posts include: Harmon S. Eberhard, executive vice president; William Blackie, who will coordinate with Peoria the administration of the Joliet and San Leandro plants and Caterpillar Tractor Co., Ltd., New British subsidiary; E. W. Jackson, vice president; Ralph M. Monk, vice president; W. H. Franklin, who will assume administrative direction of the Accounting and the Traffic & Order departments; and A. N. Whitlock, who will assume direct supervision of Accounting.

Mr. Eberhard, who has been a vice president since 1942, will share with executive vice president E. T. Brown and president Neumiller the increasing responsibilities of top administration.

Stanley Engineer Now Partner

Sanford K. Fosholt, chief engineer of the Stanley Engineering Company of Muscatine, Iowa, was recently taken into the firm as a partner on September 1, 1950.

Mr. Fosholt, a native Iowan, has been employed by the Stanley Engineering Company continuously except for a one-year period during the war when he served as an instructor in the Naval Training School (Electrical) at Iowa State College, his Alma Mater.

Mr. Fosholt's positions at Stanley Engineering Company have included a year on survey and construction work, three years on electrical design work and three years on mechanical design work. From January, 1947, until September, 1949, he served as head of the Mechanical Design Section and after that date assumed the responsibilities of chief engineer, in which position he will remain.

Alco Retirement

Retirement of Robert H. White as chief engineer, manufacturing, of American Locomtive Company and appointment of H. V. Gulick as his successor were announced by Duncan W. Fraser, president. Mr. White's retirement, effective last November 1, follows 43 years of service with the company.

He joined the Alco maintenance department in 1906 and since 1918 has been in charge of all company construction engineering. During both World Wars he supervised development of production facilities at all Alco plants and at Montreal Locomotive Works, Alco's Canadian affiliate. Mr. White also directed building, power and shop equipment projects involved in Alco's post-war expansion program at plants in Schenectady, Auburn, N. Y., Dunkirk, N. Y., Latrobe, Pa., and Chicago Heights, Ill.

Enterprise Appointments

Enterprise Engine & Machinery Co. has announced the appointment of James E. Barthmaier as district manager of diesel engine sales and service for its New England territory, with headquarters at Boston.

Simultaneously, Enterprise announced the appointment of Hugh H. Goodwin as sales engineer for its New York branch.

Barthmaier, recently district manager for Superior Engine Division of National Supply Company in Boston, has been associated with the engine

Big steel Mill saves:

6 hours of down time plus 12 man-hours on each routine roller-journal overhaul

using Snap-on* IMPACT SOCKETS and EXTENSIONS

Saving six hours of production time of a hot-broach unit in one of the largest mid-west steel mills undoubtedly earns enough money to buy many a set of Snap-on Heavy-Duty Impact Sockets!

Add 12 man-hours of skilled maintenance mechanics' time and you've got a savings total to gladden the heart of any cost-worried works manager.

This job demands removal of 16 bolts on each roller. For years it's been a slow, sledge-wrench job, averaging 8 hours apiece for two workers. Today, using a 1½" drive impact gun, with Snap-on Impact Sockets and Extensions, the job is done in 4 hours.

Such savings are frequent among Snap-on users. Snap-on's nation-wide tool service — backed by 30 years' experience in tooling every type of industry for production, assembly and maintenance operations — is your assurance of the best obtainable tools for your needs. Write for catalogs and address of nearest Snap-on branch.

Write for industrial catalog and 104-page general catalog!

*Snap-on is the trademark of Snap-on Tools Corporation.

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ROCHESTER GAUGES ARE BUILT TO

STAY ACCURATE

ON RUGGED SERVICE

When you design engines for heavy work, you make them tough enough to take plenty of hard knocks. Rochester instruments are built that way, too . . . for rugged service on your hard-working truck, tractor, auto, marine and industrial engines, both gas and diesel.

Rochester ammeters and temperature and pressure gauges are made of long-wearing metals to last as long as the engine itself. Their accurate, highly sensitive movements are protected with vibration and pulsation dampeners . . . and permanently sealed against water and dust. They always retain their original accuracy, too, even under high overloads.

Famous more than 35 years for long, dependable performance on heavy-duty service, Rochester instruments are specified as standard equipment by nearly all leading tractor and many other engine manufacturers. Bulletins on request. ROCHESTER MANUFACTURING CO., INC., 34 Rockwood St., Rochester 10, N. Y.

ROCHESTER DEPENDABLE ACCURACY GAUGES

ROCHESTER MANUFACTURING CO., INC.

DIAL THERMOMETERS GAUGES AMMETERS

field since 1936. Goodwin was also with Superior, filling the post of sales engineer in the New York area since 1940 except for a year with Sterling Engine Company. Prior to 1940, he was in the export division of Fairbanks, Morse & Co. in New York.

New Morse Western Representative

Mr. R. J. Howison, general sales manager of the Morse Chain Company, Division of Borg-Warner Corp., Ithaca and Detroit, announces that Mr. Carlton R. Becker has been recently appointed as Morse western factory representative.

He will supervise the sales of Morse mechanical power transmission products in the eleven states west of and including Montana, Wyoming, Colorado, and New Mexico. Mr. Becker's headquarters are at 1571 Harding Ave., Pasadena 7, California.

Mr. Becker formerly was associated with the J. W. Minder Chain and Gear Company, Los Angeles, who are Morse Chain distributors in this area.

Kay of Nordberg Retires

Mr. Delbert Kay has resigned his position as advertising manager at Nordberg Manufacturing Company, Milwaukee, Wisconsin, under a company retirement plan. During the 27 years that Kay served Nordberg as advertising manager, the company greatly expanded its operations until today the name of Nordberg has world-wide recognition for its diesel engines, mining and quarrying machinery and railway track maintenance equipment. Mr. Kay was in charge of advertising for all company product divisions.

Advertising duties performed by Kay have been assumed by J. D. Grace, manager, Advertising and Sales Development Department.

EMD Appointments

Appointment of Mr. Harold H. Dice to be administrative assistant of Electro-Motive Division of General Motors is announced by B. A. Dollens, general manager.

Mr. Dice, who has been director of Test and Inspection since 1946, will report directly to the general manager

Lister-Blackstone

BRINGS YOU THE MOST POWERFUL

AIR COOLED DIESELS

ON THE MARKET!

Product of the Armstrong-Siddeley group, manufacturers of the world's most powerful aerojet engine, the "Sapphire". Sold and serviced exclusively by LISTER-BLACKSTONE.

MODEL AS-1 One cylinder.
8 H.P.— 1200-1500 r.p.m.
MODEL AS-2 Two cylinder
20 H.P.—1800 r.p.m.

- Suitable for all SAE attachments
- Standard 12-volt Autolite starting
- **ATTRACTIVELY LOW-PRICED.**
- **AVAILABLE FOR DELIVERY.**
- **PLENTIFUL PARTS STOCKS THRU LISTER-BLACKSTONE DISTRIBUTORS EVERYWHERE.**

Write for literature and prices. Outline your requirements. Address Dept. T.

LISTER-BLACKSTONE, Inc.
Factory, Sales & Service Headquarters
420 Lexington Avenue New York 17, N. Y.

in his new post and will be responsible for activities relating to manufacturing, engineering, production control, purchasing and inspection.

Mr. Dollens also announced appointment of Mr. John H. Anderson to succeed Mr. Dice as director of Test and Inspection. Mr. Anderson has been Assistant Director of Test and Inspection since February, 1949.

Admiral Mather to De Laval

Mr. Geo. C. Stoddard, president of The De Laval Separator Company has announced that Rear Admiral Paul L. Mather, U.S.N. (retired), has become associated with the company as manager of its Precision Equipment Division, and special assistant to the president. In this position Admiral Mather brings to The De Laval Separator Company a wealth of experience gained during the many phases of his career as a Naval officer and Government official.

He is singularly fitted to head the De Laval Precision Equipment Division which manufactures precision equipment of various types for the Merchant Marine, the Armed Services and industrial users.

Following retirement after a distinguished Naval career, Admiral Mather was called back to active service as deputy administrator of the War Assets Administration, later associate administrator and finally as administrator.

In May 1950 President Truman appointed Admiral Mather acting member of the newly created Federal Maritime Board which duties he completed August 21st.

Borg-Warner Vice President

Mathew Keck has been elected a vice president of Borg-Warner by the board of directors. He also will continue in his post as treasurer.

Mr. Keck joined the Borg & Beck Co., in Moline, Ill., in 1920 as controller, then became secretary-treasurer. He was named secretary-treasurer of Borg-Warner when the corporation was formed in 1928, with Borg & Beck as one of the four original founding companies. He retained that post until last April, when he became treasurer and Ray W. Dose was named secretary.

Mack Vice Presidents

S. S. Stewart has been named vice president in charge of purchasing for Mack Manufacturing Corp., according to an announcement by E. D. Bransome, chairman and president.

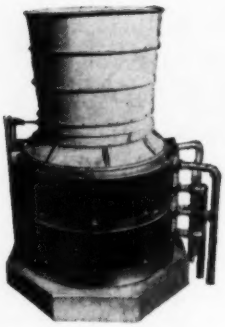
Mr. Stewart was formerly purchasing agent for the manufacturing division of Air Reduction Sales Co. He had been associated with that company since 1934. Prior to that he was with Wilson Welder & Metals Co., which was later purchased by Air Reduction.

A. R. Kelso has been elected vice president of Mack Trucks, Inc. At the same time Mr. Kelso was named vice president and a director of Mack Manufacturing Corp., the parent company's wholly-owned manufacturing subsidiary.

In his new position Mr. Kelso will be in charge of manufacturing and

Pritchard's NEW Quintair*

AIR COOLED HEAT EXCHANGER



For Low Cost, Dependable Cooling of Engine Jacket Water and Lubricating Oil

- Lower Installed Cost
- Higher Efficiency
- Fewer Parts to Assemble
- Lower Maintenance Costs
- Lower Operating Costs
- Many Industrial Uses

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production at all Mack plants. He will make his headquarters at Allentown, Pa., site of the 50-year old company's main assembly plant.

Mr. Kelso joined Mack early this year as production counsellor. Previous associations include the U. S. Cartridge Co., Hudson Motor Car Co., Continental Motors Corp., and Motors Products Corp.

Hunt-Spiller Announcements

Melvin O. Sten, chief engineer, Hunt-Spiller Manufacturing Corp., Boston, recently completed 25 years of service with the 140-year-old company, producer of diesel cylinder liners and other components. A graduate of Northeastern University, he joined Hunt-Spiller Nov. 3, 1925, as a draftsman.

At the same time it was stated that Gordon L. Leach has resigned as manager of the automotive division. He was with the company since 1930.

It was further announced that William E. Mulcahy, recently with Boston Electro Steel Co., has re-joined Hunt-Spiller as assistant foundry superintendent. Mr. Mulcahy, who entered the foundry field at Hunt-Spiller in 1941, served as castings inspector, assistant chipping room foreman, cleaning department foreman, assistant to the works manager, and in his present post. Announcements were made by A. J. Edgar, vice president and general manager.

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SAVES FUEL & LUBE OIL
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HAVE YOU A JOB FOR A TRAINED MECHANIC?

We have a number of alert young men who have completed intensive training in Diesel Mechanics. They learned their trades thoroughly by working on actual equipment under personal, expert supervision. If you need a trained man, we invite you to write for an outline of our course, and for a prospectus of the graduate. No fees, of course. Address:

Placement Manager, Dept. P-103-12
COMMERCIAL TRADES INSTITUTE
1400 Greenleaf Chicago 26

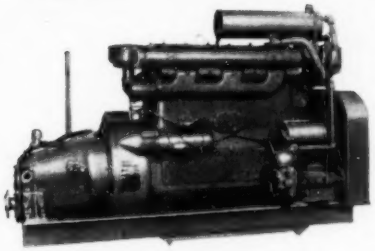
Twin Disc Appointments

The Twin Disc Clutch Company, Racine, Wis., recently announced the appointment of Paul W. Whaler as service manager and Robert A. Harmon as dealer sales supervisor. Both men will make their headquarters in Racine.

Mr. Whaler, a graduate engineer of the University of Wisconsin, joined the company's engineering department in 1937. He later served in various capacities, interrupted only by service in the Army. His new duties will be to supervise all service operations through the five factory owned parts stations supplying parts to all Twin Disc outlets.

Mr. Harmon, a graduate of Case Institute of Technology, Cleveland, has been connected with sales engineering since joining Twin Disc more than three years ago. He served as field representative and as eastern district sales engineer before promotion to his present duties of coordinating all dealer sales activities.

CONTINUOUS
DEPENDABILITY
FOR OVER 50 YEARS



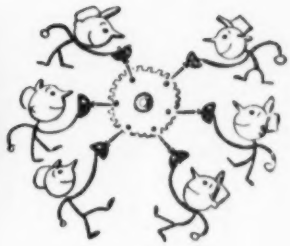
MARINE
PROPULSION UNITS

10 to 60 hp 2, 4, and 6 Cylinders

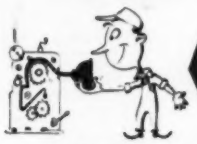
HILL DIESEL

HILL DIESEL ENGINE CORP.
LANSING, MICH.

Manzel
AUTOMATIC FORCE FEED LUBRICATION
Gives each wearing point a full-time 'oiler'



Frees manpower for more productive jobs.



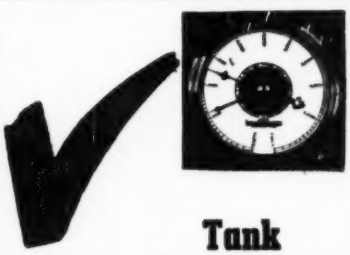
Reaches vital parts ordinary methods can't lubricate.

Meters the precise amount of oil needed.

Manufacturers using Manzel Lubricators report that they save their initial cost many times over in reduced labor cost, lower oil consumption, and fewer breakdowns. "Manzels" are standard equipment on many makes of engines, pumps, compressors, hydraulic presses, conveyors, and other machinery. Or...you can install them on present equipment.

Manzel representatives will gladly supply technical assistance on lubrication problems.

Manzel
Division of
FRONTIER INDUSTRIES INC.
275 BABCOCK ST.
BUFFALO, N. Y.



Tank
Contents At A Glance

With Liquidometer remote reading fuel storage tank gauges you can check quickly and accurately oil deliveries, consumption and amount on hand. No Diesel plant is complete without one. Liquidometer or Levelometer models are available for tanks of any capacity

Write for complete information

THE LIQUIDOMETER CORP.
36 24 Skillman Ave., Long Island City, N. Y.

Purolator Regional Office

R. C. Swenson Jr., has been appointed regional manager of Purolator Products, Inc., with headquarters at the Purolator offices, 122 South Michigan Avenue, Chicago. Announcement of the appointment was made by Howard Hopkins, manager, Jobber Division.

Mr. Swenson resigned from government service, where he was materials engineer in the Industrial Manager's office of the 9th Naval District, in order to come to Purolator.

Harlan Plant

(*Concluded from Pg. 45*)

might be left with an over-expanded plant if REA turned to other sources of power. As the city's own demand for electricity increased through normal community growth and the greater popularity of electric appliances, REA was encouraged to plan its own power supply. As a result, the co-op built a plant of its own and reduced its demand on Harlan to approximately 850 kw.

Peak loads and kw. hr. production at the Harlan plant were almost identical in 1948-49 and 1949-50, but the nature of the load was undergoing an important shift. Solid, more profitable city load was replacing lower-rate REA load. It is expected that this shift will continue in the years ahead so that eventually, the Harlan diesels will drop REA entirely.

Responsible for this development program have been Supt. Woodhouse and a veteran Board of Trustees: H. P. Dowling, chairman; Morris Frederickson, who have served since 1920; and A. B. Parker, who has been a trustee since 1922.

This program has given Harlan an 8385-hp. power plant with conservative, heavy-duty prime movers capable of producing power with high efficiency and economy. In meeting the demands of the area, these engines have run hundreds of thousands of hours and produced well over a hundred million kilowatt-hours. Today, bolstered with new, modern generating equipment, the plant is prepared to meet with even greater efficiency the demands of the future.

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The new Piston Ring material for tough service in heavy duty Diesel and Gas Engines

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CYCLAN is tough, with plenty of tension, but not brittle

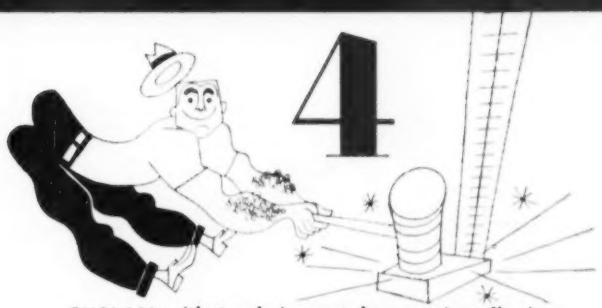
2

CYCLAN has twice the breakage resistance of ordinary iron

3

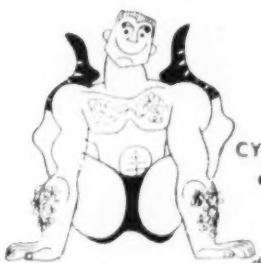
CYCLAN will not change structurally under heat

4



CYCLAN withstands impact, hammering, flexing

5



CYCLAN withstands considerable distortion without losing shape

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CYCLAN resists wear far better than standard ring iron

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MUSKEGON, MICHIGAN

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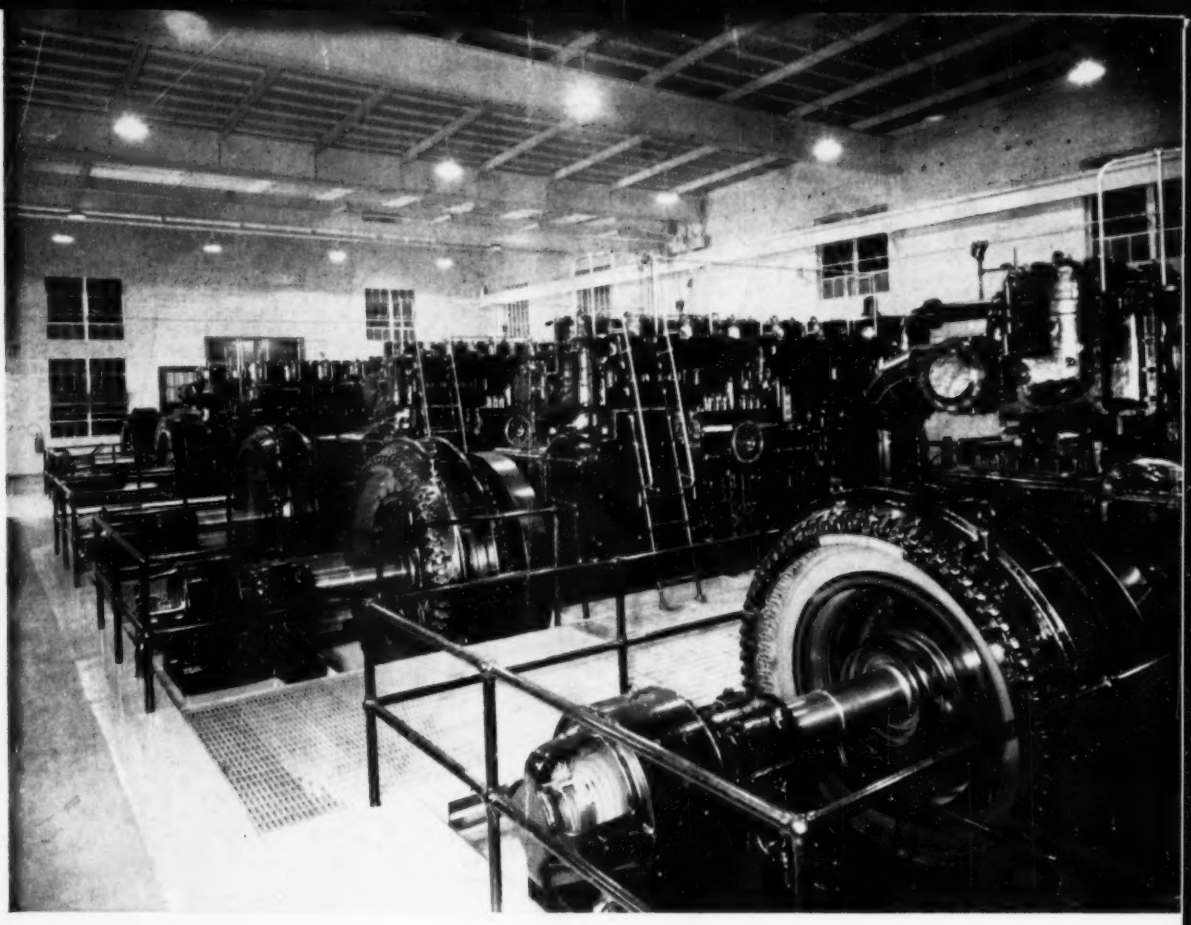

NO lubricant change in 40,000 hours!

● A 10-cylinder 2,000-HP Fairbanks-Morse Diesel at the City of Jacksonville, Illinois, municipal power plant has required no change of its lubricant in over 40,000 hours of operation on STANDARD HD Diesel Oil. In all of this time, STANDARD HD has shown practically no deterioration. The engine crankcase has remained entirely free from deposits.

The piston rings in this same engine were in operation for 14,206 hours, and on inspection revealed not one broken or stuck ring. There was so little wear of the rings that, in most cases, the original tool marks were clearly visible.

Such lubricating efficiency is especially significant when the size of the Jacksonville plant is considered. Five F-M units, totaling 6,975 horsepower, a new 2,000-HP unit having been recently installed, make this plant one of the largest Diesel installations in Illinois. STANDARD HD in all units has helped keep maintenance costs at a rock-bottom low.

The experience of the Jacksonville plant indicates the savings you can expect to make by using STANDARD HD Diesel Oil. This truly heavy-duty lubricant owes its superiority to the combination of effective oxidation-resistant and detergent additives with solvent-extracted base stocks of highest quality. A Standard Oil Lubrication Engineer will help you obtain the best possible economy.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

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